FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

Editor C. M. POULSEN

Managing Editor G. GEOFFREY SMITH, M.B.E.

Chief Photographer JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY:	BIRMINGHAM, 2:	MANCHESTER, 3:	GLASGOW, C.2:
8-10, CORPORATION ST.	GUILDHALL BUILDINGS, NAVIGATION ST.	260, DEANSGATE.	26B, RENFIELD ST.
Telegrams: Autocar, Coventry.	*Telegrams:* Autopress, Birmingham.	*Telegrams:* Iliffe, Manchester.	*Telegrams:* Iliffe, Glasgow.
Telephone: Coventry 5210.	*Telephone:* Midland 2971 (5 lines).	*Telephone:* Blackfriars 4412.	*Telephone:* Central 4857.

Registered at the G.P.O. as a Newspaper.

No. 1782. Vol. XLIII. February 18th, 1943. Thursdays, One Shilling

The Outlook

The New Commands

SIR ARTHUR TEDDER has had the very briefest tenure of the office of Vice-Chief of the Air Staff that any man can have had. He now goes back to Africa, where he has established already a brilliant reputation, to hold a newly created post of a scope wider than any Air Officer has yet held. Though subordinate to General Eisenhower, he becomes Commander-in-Chief (presumably the correct title is Air Officer Commanding-in-Chief, though that has not been definitely stated as yet) of all Allied Air Forces in the Mediterranean. These include the British Empire squadrons, the Americans, and doubtless in due course the French will be added to the total. Under him, Air Vice-Marshal Coningham will be in charge of the air squadrons which will support the First and Eighth British Armies. That obviously implies that the American Army Air Force will also take its directions from Air Vice-Marshal Coningham.

Never before has there been taken such a comprehensive step designed to avoid the evils of divided command. There is now in North Africa one supreme commander placed over all the forces, sea, land and air, of three fighting nationalities. The British and the French will fight willingly and enthusiastically under the eminent American who is at the head of the whole campaign. It is significant that he is an Army officer. He, also enthusiastically, has agreed that the fleets, the armies and the air contingents shall all fight directly under British officers. While Admiral of the Fleet Sir Andrew Cunningham is at the head of all the naval forces, General Alexander is to command the First and Eighth Armies, into which General Eisenhower has said that he will throw all Americans who can fight. The French General Koeltz is commanding a Corps in General Anderson's First Army, while the American General Ryder has a Division in that Corps. There will be no occasion for the requests and negotiations which so hampered the co-operation of the French and British Armies from 1914 till the spring of 1918. Orders will be given, and it is orders which sailors, soldiers and airmen understand and unquestioningly obey.

The Luftwaffe at the Stretch

COMMENT has been made in *Flight* on several occasions about the paucity of references to air action during the winter offensive of the Russian armies, and also to the small numbers of German aircraft claimed by the Russians as captured or destroyed, in comparison with the enormous hauls of guns and tanks. The obvious inference was that the Germans were flying their machines back to the rear before their airfields were overrun. Whether they saved much of the ground equipment is another matter, but if they did not, the retreating aircraft could hardly turn and fight with much effect. That would mean that the German troops must be deprived of adequate air support, which may in part account for the speed of some of the Russian successes. The latter have been using Cossack horsed cavalry in the winter to do much of the work which aircraft would normally do in finer weather.

Round Leningrad, however, the Germans say that air support for the Russian tank thrusts is the chief feature of the battle. The confused state of the *Luftwaffe* is shown by the Russian report (obtained from prisoners) that Stuka squadrons have been moved from Tunisia to the Krasnodar front.

The German fighter strength is now strained to the utmost, and, of course, certain kinds of bomber work are impossible unless fighters can command the air above. For a long time past roughly half of the total

fighter strength of the *Luftwaffe* has been kept in Northern France and the Low Countries to prevent the R.A.F. from having things all its own way. It has lately been estimated with some assurance that one-fifth of all the single-engined fighters of the *Luftwaffe* has been congregated in Tunisia, in addition to other squadrons in Sicily and to a certain number of Italian fighters. That leaves a small proportion for use against the Russians and for guard duties in Norway and the Balkans.

These facts set one wondering as to what the German air strategy really is. Armies cannot win battles without air support, and the German disposition of their fighter squadrons shows that their High Command is now struggling in a cleft stick.

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Freedom of the Air

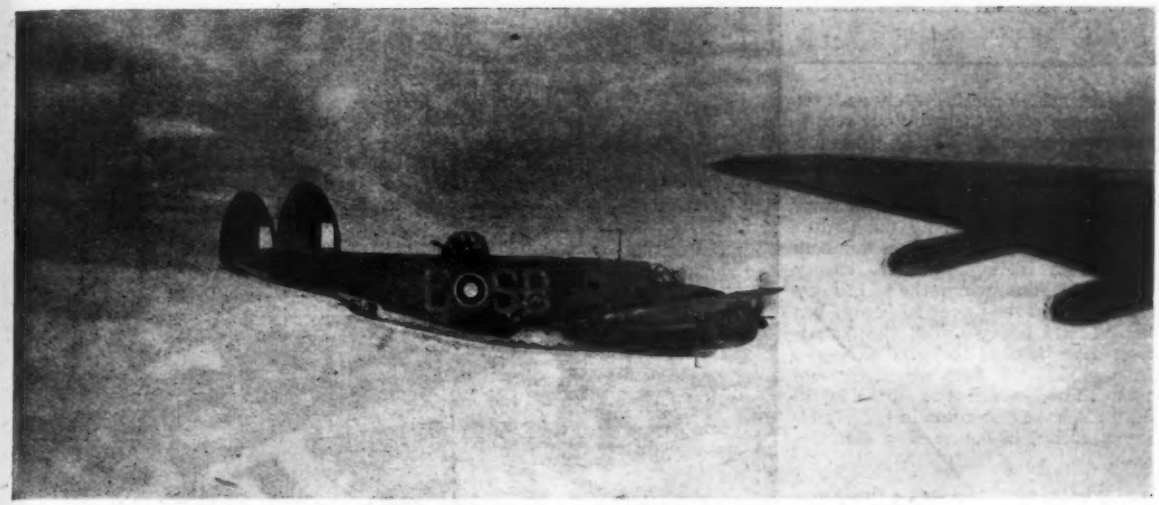
HOW right was Lord Trenchard when, in the House of Lords last week, he said that the one point which will govern all post-war air-transport is the question of the freedom of the air, was shown a couple of days later, when reports reached this country of certain statements and utterances made in America. While the question of air transport was being debated in our House of Lords, Mrs. Claire Booth Luce was arguing in the United States House of Representatives against freedom of the air. We in this country need not feel annoyed with Mrs. Luce for her somewhat outspoken views. As the wife of the proprietor of such magazines as *Time* and *Life*, she is but carrying out the family policy in the House of Representatives. That policy may not be exactly helpful at the present moment, but it is well that we in this country should realise that it exists, and that its views are shared by quite a considerable proportion of Americans.

So far from taking offence, we should welcome such frank expressions of opinions. The bond that has been forged between the United States and Great Britain will have to withstand many a strain during the post-war years. We do not feel that this particular subject of freedom of the air, air bases and suchlike, is likely to prove a serious stumbling block. It should not be beyond the statesmanship of the two nations to find ways and means of solving such problems in a manner fair to both. If the young men of Great Britain and the United States can fight side by side in the air, as they are doing now, it is surely not too much to hope and expect that these same young men would be able, after the war, to work side by side in air transport at different bases of commercial interest and importance to both countries.

Much depends upon the interpretation of the phrase, "Freedom of the Air." Probably few would advocate unlimited freedom. But the use of airports, radio facilities, customs and so forth, must undoubtedly be open to all, just as seaports are open to the nations of the world. Landing fees would probably have to be imposed in order to pay for services rendered, and it is scarcely to be expected that one nation's air lines would be permitted to pick up passengers at the airports of another nation for transport to places in that country. All that is likely to be necessary, in most cases, is freedom of passage and access to ground facilities.

There must be a *quid pro quo* in the relationship between ourselves and the United States, nor is there any reason to doubt that that could be arranged.

CARRIER FIGHTERS: Grumman Martlet six-gun fighters ranged on the flight deck of an aircraft carrier of the Royal Navy.

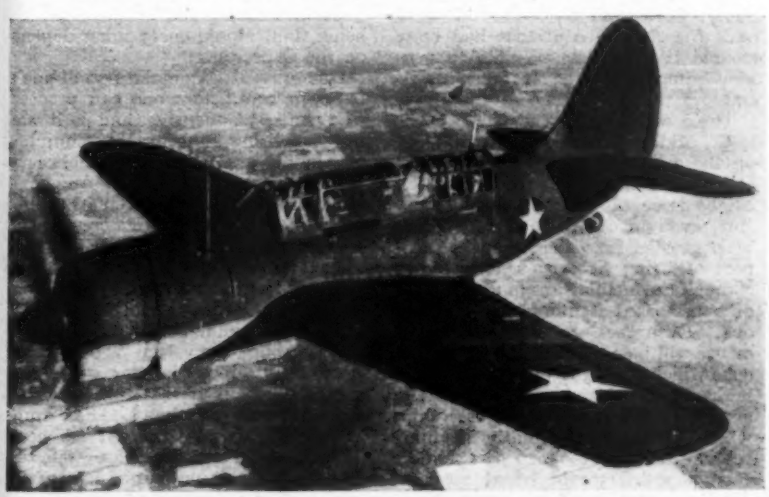


OVER THE CLOUD LAYER: Venturas of Bomber Command on daylight operations.

WAR in the AIR

Guadalcanal Conquered : Profit and Loss Accounts : Mediterranean Reorganisation : Sir Arthur Tedder's New Command

APART from the splendid Russian successes, which come so thick and fast that only military correspondents can be expected to follow them, the best news lately has been the entire evacuation of Guadalcanal by the Japanese. The leaders of the Allies have admitted that they are merely holding the Japanese until they have finished with the Axis in the West, but it is very satisfactory that while this is the main strategy a considerable tactical success should have been scored against the enemy in the Pacific. It has been computed that their efforts in the Solomons have cost the Japanese some 50,000 men, of which about 32,000 have been killed at sea. Most of the latter were probably drowned when their transports were hit by torpedo or bomb by the American warships and aircraft. Their losses in ships have also been very heavy, for in these operations it is believed that one Japanese battleship was sunk besides many cruisers and other vessels, and that among the ships damaged there was at least one aircraft carrier. These shipping losses (said to amount to 160 sunk or damaged) are probably what hurt Japan most. The Americans also say that they have shot down 797 Japanese aircraft in air combat, in addition to those they bombed on airfields. It is thought probable that the Japanese intend to evacuate the whole of the Solomons group, which would be a great loss of "face" and would remove one serious threat to Australia.



CURTISS DIVE BOMBER: The new A-25 which is the U.S. Army's version of the Navy's Helldiver. The A-25 has a 1,700 h.p. Wright-Cyclone and a three-bladed constant-speed Curtiss electric airscrew.

Some other interesting figures of enemy air losses have been published. In the three months of the Allied occupation of French Africa the Axis has lost 607 machines, of which 343 fell to the U.S. Army Air Force, 163 to the R.A.F., 29 to A.A. gunners by day, while by night 72 were destroyed by fighters and ground fire. During the same period the Allies lost only 250 machines, 163 Americans and 87 R.A.F. This report takes no account of gains and losses by naval aircraft.

The crossing of the narrows from Sicily to Tunisia is now a parlous business, and one does not envy the sailors (presumably mostly Italian) who undertake it. Most of the ships destroyed fall to British submarines, which have been doing magnificent work, despite the clearness of the waters of the Mediterranean, which makes it comparatively easy for aircraft to see a submarine below the surface. It may be presumed that

WAR IN THE AIR

our submarine captains often work on intelligence given them by our reconnaissance aircraft, which thus are entitled to a share of the credit when an enemy ship is sunk.

Both from French Africa and from the territory occupied by the Eighth Army British and American bombers have been hitting hard at enemy bases. Messina, where the train ferry from Italy crosses over to Sicily, has had several heavy raids; the Americans have bombed the port of Naples in daylight and done much destruction there, while the airfields in Sardinia have also come in for poundings. Sicily, of course, is a standing dish.

Air Chief Marshal Sir A. Tedder

THE new organisation of Commands in the Mediterranean announced by Mr. Churchill are discussed in our leading columns. Here we may refer to Sir Arthur Tedder's appointment as Air Officer Commanding-in-Chief, the Mediterranean. During the advance of the Eighth Army to Tripoli he was A.O.C.-in-C., the Middle East, Malta being a subordinate Command under him. Before the war Malta was designated the Mediterranean Command of the Royal Air Force, and was independent of the Middle East, as it was mainly concerned with naval operations. There has never before been a Mediterranean A.O.C.-in-C., but now this has become a necessity as American squadrons will be working under Sir Arthur Tedder. In our issue of January 21st last the question of co-operation of forces in the Western Mediterranean was briefly discussed, and the situation was described as "an interesting picture." It was also stated that "it all sounds very complicated, but apparently it works." The complications have now been ironed out in a manner which seems entirely satisfactory and which promises the best results in the future.

General Alexander's Estimate

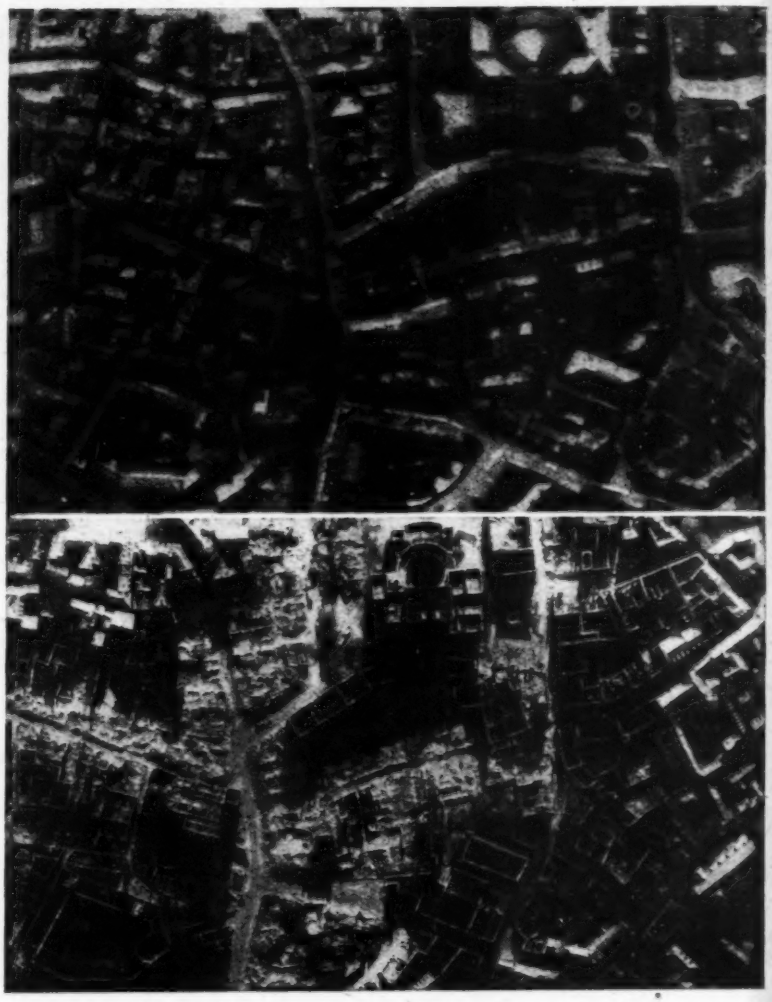
ON February 10th General Alexander made a statement to journalists at Cairo. He must have known that he was bound for fresh fields and pastures new, but those who heard him were still ignorant of the new arrangements made at Casablanca. The General said that at the moment we had not secured airfields close enough to Bizerta, Tunis and Sfax to operate round-the-clock bombing of those supply ports, but that the possibility of doing so was rapidly approaching. When that was possible the supply problems of the Axis would be greatly handicapped—as one can easily understand.

General Alexander said that the Mediterranean would never be really safe until the Allies had captured Sicily, Crete and Sardinia, but that once the African continent had been cleared it should be possible to provide sufficient air cover for military convoys.

These words show that the G.O.C.-in-C., Middle East, has been thinking on the same lines as the writer who contributed a special article to the *Flight* issue of December 3rd, 1942. But, even before those islands have been wrested from the Axis, the prospect of being able to send convoys through the Mediterranean under cover of shore-based fighters is a dazzling one. Even the least imaginative observer will be able to realise the difference which such a development would make to the shipping position. The enormous train of transport ships which has been consistently steaming round the Cape to keep the Middle East supplied would be at once set free for other work.

The Eighth Army has not yet reached a point at which it can get its supplies from the West. That, we hope, will come soon, but for the time being Gen. Montgomery must depend on the Cape route.

One must always make sure of one's bases in war before one can proceed to a confident offensive, and so it was not surprising to hear Mr. Churchill say in his great speech on February 11th that the British and American Governments have given the first priority to the task of overcoming the U-boat menace. That implies that Bomber Command must have been given orders to strike at all which concerns the U-boat as often and as heavily as possible. The daylight raid on Augsburg some time ago was one very heavy blow in this campaign, and the recent devastating raid on Lorient was another. The works which manufacture the various components of the U-boats are well dispersed, but the number of bases from which they can operate is limited, and Lorient is one of the most important. The Germans have ordered the evacuation from that place and from Brest



COVENTRATED: Two air photographs of the German City of Mainz before and after attention by the R.A.F. The domed building at the top is the municipal theatre.

ENEMY AIR LOSSES TO FEB. 13th.

	Ove G.B	Over Continent	Middle East
Feb. 7	1	0	3
" 8	1	0	1
" 9	0	3	2
" 10	3	0	0
" 11	0	0	0
" 12	0	0	1
" 13	0	4	0
	5	7	7

Totals : West, 6,618 ; Middle East, over 5,217.

of all persons not directly engaged on the war work of the ports. It is welcome news. Heavy raids are bound to cause casualties among the civilian populations of the places bombed, and it is a grief to us when our very necessary operations cause afflictions to French families.

The Russian Front

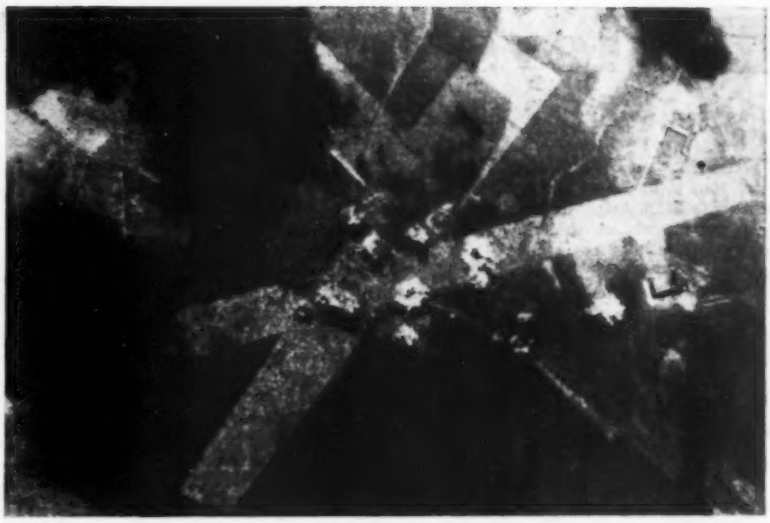
LAST week ended with the splendid news that the Russians had captured Rostov and Voroshilovgrad, and other successes may have been obtained by the time these words are in the hands of our readers. We all hope that further large forces of the Germans and their satellites will be cut off and either exterminated or forced to surrender.

BRITISH & U.S. AIR LOSSES TO FEB. 13th.

	Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
Feb. 7	0	7	1	1
" 8	0	0	0	2
" 9	0	0	3	1
" 10	0	0	3	0
" 11	0	4	1	0
" 12	0	0	1	1
" 13	0	8	6	1
	0	19	15	6

Totals : West, 5,199 ; Middle East, about 2,073.

Reports from the Russian front have lately given small prominence to the air side of the fighting, but the Russians have declared that in the week which ended on February 13th they had destroyed 243 German aircraft in the air and on the ground, losing 101 machines themselves. That presumably refers to the whole of the enormous front, and does not suggest very intense air fighting on any one sector. The Germans say that round Leningrad the support which Russian aircraft are giving to their tank thrusts is the outstanding feature of the battle, and it is also reported that Soviet bombers are attacking the only railway line by which one German army can hope to escape. Everywhere there is talk of the superiority of Russian artillery, which implies observation from the air.



BURMESE WAR : Bombs from R.A.F. bombers bursting on the runways of the Japanese occupied airfield at Pokokku.

Enemy Aircraft Development

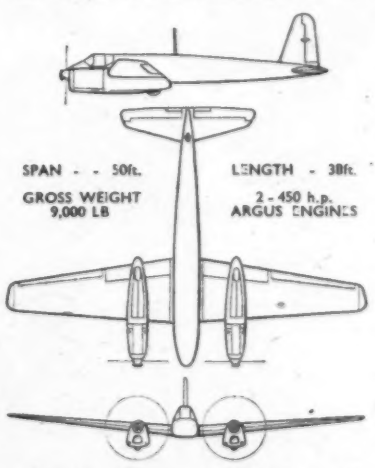
Henschel Hs 129

IN our issue of August 27th, 1942, we published scale drawings and brief particulars of the Henschel Hs 129 ground attack monoplane. On December 3rd we gave a few details of its armament and stated that the speed was 285 m.p.h. This information can now be supplemented by the following facts. The armouring of the Hs 129 is very comprehensive, the welded steel tube fuselage front portion being entirely covered with plates varying in thickness from 6 mm. to 12 mm. The bullet-proof glass windscreen is 3in. thick and is mounted in a frame of 6 mm. armour! The lower half of the engine nacelles, the carburettors, oil coolers, etc., are protected by 5 mm. armour plate.

Armament of the Hs 129 comprises five guns. On each side of the fuselage there is a 7.9 mm. and above it a 15 mm. gun. The 30 mm. cannon is carried below the fuselage. It may be replaced by bomb carriers.

Me 109G-2

A recent version of the Me 109 is the 109G-2, which has a Daimler-Benz 12-cyl. liquid-cooled inverted-V engine, said to develop 1,500 h.p. at 16,000ft. The engine is generally similar to the DB601, but presumably the degree of supercharging has been increased. Other sub-types of the 109G have a pressure cabin.



General arrangement drawing of Henschel Hs 129 with Argus engines. Another version has Gnome Rhône 14 M radials.

Armament of the Me 109G-2 consists of one 20 mm. M.G.151 firing through the airscrew boss, and two 7.9 mm. machine guns mounted above the engine. Provision is made for fitting in addition one 20 mm. M.G.151 gun under each wing.

Ju 87D-1

Modifications have been introduced on the Junkers Ju 87. The armouring has been considerably increased in the Ju 87D-1 and now includes complete armouring of the pilot's seat with 8 mm. plates at the back and 4 mm. plates at the sides. The rear gunner is protected by an 8 mm. transverse bulkhead and a 5 mm. floor plate.

Armament comprises two 7.9 mm. machine guns in the wings and two in the rear cockpit. The installation of the Junkers Jumo 211 F-1 engine has been modified, the shape of the cockpit cover changed, and certain modifications incorporated in the undercarriage. Readers who have been puzzled by the "knobs" on the undercarriage legs will be interested to know that they are sirens which wail during a dive.

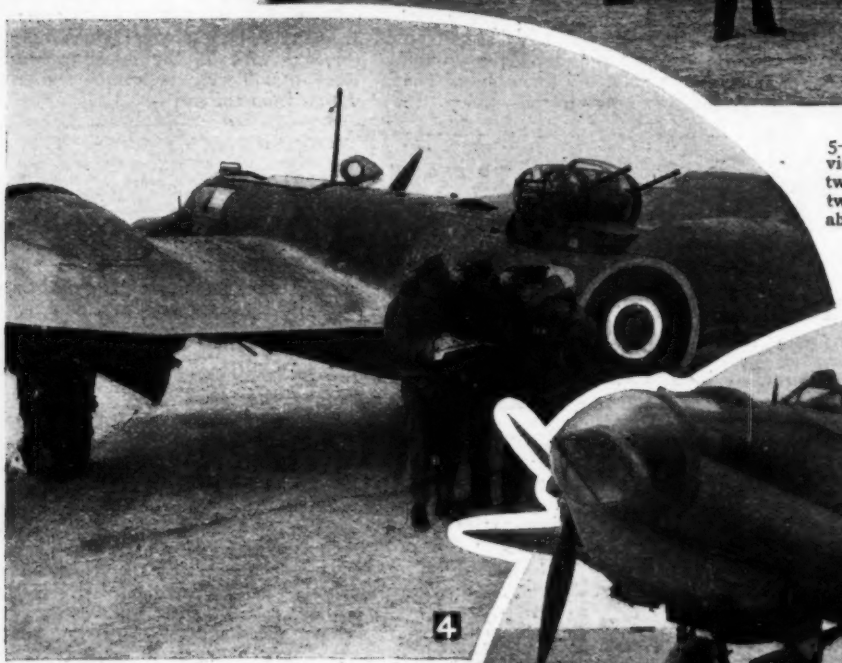
Bisleys in North Africa

New Bristol Close Support Bomber Now Taking Part in the Attack on Tunisia

THE Bristol Bisley, alias Blenheim V, alias Bristol 160, is in service as a close support attack bomber with the First Army on the Tunisian border. There are various models of the Bisley, some have transparent noses and others are unglazed forward from the pilot's cockpit. All have Bristol Mercury engines with de Havilland two-position controllable-pitch airscrews.

For service in North Africa air cleaners have been fitted because, although at the moment mud is the major problem, it will not be long before dust will be an even greater nuisance. Close support machines do not operate at any very great heights and it has not been found necessary to fit snow guards in front of the air intakes. The twin guns for the rear gunner are, of course, power operated by an hydraulic turret of Bristol design.

1—Taking off the engine covers. Aircraft on service seldom see the inside of a hangar and the essential parts are covered to protect them from the worst of the elements.



5—(Below) Interesting features in this view of the Bisley are the rearward-firing two-gun blister turret below the nose, the twin bays to take the bombs, the mirror above the pilot, and the large clear-vision panel for the bomb-aimer.

4—The entrance to the Bisley fuselage is through the roof in the same manner as in the Blenheim. The D.F. loop is carried in a transparent streamlined case. The power turret carries two .303 Browning machine guns. Stops in the turret mechanism prevent the guns from being fired while they point at any part of the aircraft.

2—The building which houses the officers' mess is of typical Moorish architecture. Usually coloured white or pale buff, these buildings look extremely effective against the intense blue of the Mediterranean sky. That is when it is not raining.

3—The travelling headquarters of the squadron opens outwards to give more room to perform the inevitable paper work.

6—(Above) Anyone who has been east of Gibraltar will recognise a familiar scene in the bargaining with the local population for tangerines, oranges, eggs and other produce. As a start, one cuts the price asked in half and an agreed figure is eventually reached after much haggling.

7—No newsvendors serve African airfields. A summary of the day's news, received over the short-wave transmitter of the B.B.C, is posted on an improvised notice board outside the squadron headquarters.

HERE AND THERE

U.S. Planes for China

MR. HENRY WALLACE, America's Vice-President, stated recently that China will soon be receiving American combat planes with which to attack Japan.

Things to Come

LT.-GEN. FRANK MAXWELL ANDREWS, who recently succeeded Gen. Eisenhower as C.-in-C. of the U.S. Army in Europe, has said: "We intend to go all out in intensifying our air warfare."

He is an ardent believer in strategic bombing and has had 26 years' experience as an airman.

Birmingham Opinion

THE Campaign in North Africa might now be over, according to Mr. Oliver Simmonds, a Birmingham M.P., if we had made greater use of airborne troops at the time of the landing. The Axis infiltration into Tunis and Bizerta, he said, might have been stemmed by a few thousand of such troops.

Until we were able to make good modern transport aircraft Mr. Simmonds is of the opinion we should ask the U.S. to supply an adequate number.

Canadian Air Chiefs Here

THE arrival in England from Canada of Air Marshal L. S. Breadner, Chief of Canadian Air Staff, Air Vice-Marshal K. G. Nairn, Air Member for Accounts in the Canadian Air Council, and Air Comdre. E. E. Middleton, Deputy Air Member for Personnel, has recently been announced.

They are over here to take part in discussions.

Canada's Air Transport

THAT Canada must guard against becoming an arena for commercial airline rivalry after the war is stressed in an article in an Ottawa newspaper, *The Evening Citizen*, whose Washington correspondent, R. T. Elson, points out that one safeguard would be to keep the control of trunk lines within Canada entirely under public ownership, a national policy the soundness of which has been demonstrated by Trans-Canada Air Lines, which has no dividend considerations.

Mentioning that Pan American Airways is now an international enterprise with government support from Washington, the writer anticipates the development of rivalry by private subsidiaries setting up vested interests on the Canadian route to Alaska and making it a commercial cockpit.

Best They Can Do?

FROM inspections of German aircraft which we have captured, it appears that instead of new designs being developed, the Germans are concentrating on improving existing types, in order to offset the superiority in fire-power of such planes as the Typhoon and Flying Fortress.

Armour plate for protection of crew and engines is being used more extensively and seems to be the principal modification to Axis aircraft.

A.T.C. Appointment

COMMAND of the Central Command A.T.C., which includes units in Herts, Bucks, Middlesex, Berks and Oxfordshire, has now been taken over by Air Chief Marshal Sir Charles Burnett. He succeeds Grp. Capt. T. W. C. Carthew, who has had to resign owing to ill-health.

Air Crews from Canada

AMONG recent arrivals from Canada are "teams" of air crews who are fully trained, having had several months' flying together from operational bomber stations in Canada.

Also included in the convoy were more pilots, observers, navigators, etc., and also R.C.A.F. ground crews and Canadian W.A.A.F.

Wear and Tear

AN R.A.F. officer in Canada was recently assailed by a young lady, who asked: "Are you in the R.A.F., or did you sleep in your uniform?"

This wisecrack was made as a result of comparison between the hundreds of newly commissioned officers in Canada, and their experienced comrades.

Victory by Combined Operation

LORD LOUIS MOUNTBATTEN, Combined Operations Chief, has stated that when the enemy has been driven from Tunisia, we shall have to carry out a combined operation, with a seaborne expedition, protected by the R.A.F., in order to find somewhere else to fight.

But Lots More Yet

THE MARQUESS OF LONDONDERRY, Chief Commissioner Civil Air Guard in Northern Ireland, is of the opinion that there is a lot of work to be done before victory is achieved. He said although he had no doubt the war is now won, people should not feel complacent and take things easy.

Death of Dr. Frommer

RESEARCH metallurgist on the staff of Rolls-Royce, Ltd., since 1936, Dr.-Ing. Leopold Frommer has died, at the age of 50, following an operation.

Dr. Frommer was born of Polish parents and spent most of his life in Germany, obtaining his mechanical engineering diploma at the Technical University of Berlin. Later, he turned his attentions to physical chemistry, and came to this country in 1934 when driven out of Germany by the Nazis.

R.Ae.S. Annual Meeting

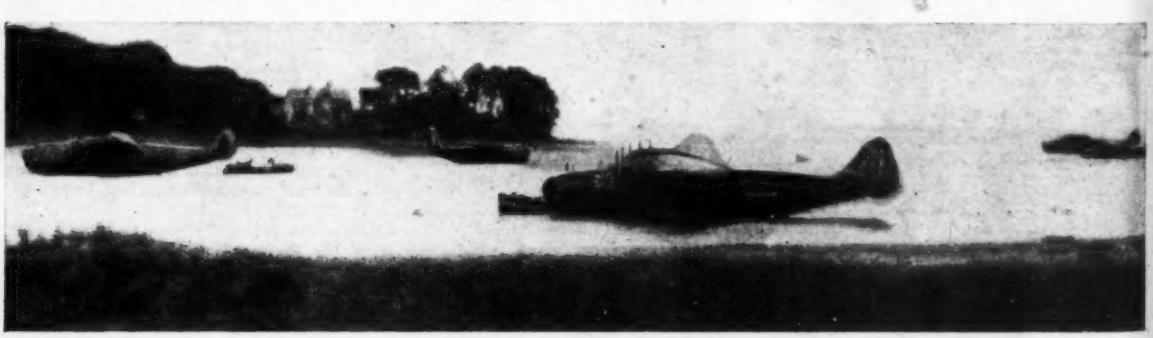
THE Royal Aeronautical Society is to hold its annual general meeting on Saturday, March 27th, at 3.30 p.m., in the Society's offices at 4, Hamilton Place, London, W.1.

Among other business on the agenda, the list of Fellows elected by the council during the past year will be announced.

"Flight" Index

THE index for the January-June, 1942, issues of *Flight* is now available, price 7½d., including postage, or together with binding case 4s. 4d.

Readers' copies can be bound at a cost of 13s. 3d., including postage, on the return of the completed volume, but, owing to shortage of staff, we must ask our readers' indulgence in the matter of delivery of the bound volume, which cannot be completed as expeditiously as in normal times.



MARINE TERMINUS: Three Boeing 314s, a Short "G" class, and a Catalina at their moorings at one of British Overseas Airways' marine airports. Waiting to take off for the United States and West Africa, these flying-boats symbolise the Anglo-American co-operation in air transport anticipated after the war

A German DFS 230 glider, to carry ten men, shot up on an airfield near Daba during the Allied advance across the Western Desert.

War Gliders

The New Tactics of "Vertical Envelopment" : Trainers and Troop Carriers : Some American and British Types in Production

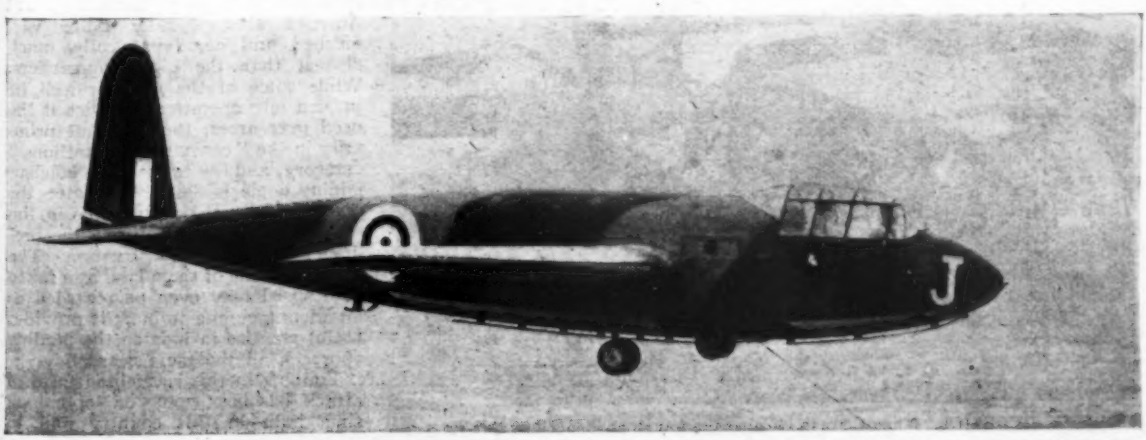
By N. D. RYDER

BRITAIN invented the tank in the 1914-18 war. Germany introduced the glider as a piece of practical military equipment during the present upheaval, while Russia may be said to have "invented" the troop-carrying glider and air-trailer transport.

Quite early in the present war one heard rumours of giant gliders being built by the Germans; they were to be used to invade this country, it was said. Many discredited the practical usefulness of the glider in warfare, but the Germans showed it could be taken seriously when they successfully employed this means to invade Crete. Admittedly it proved an expensive business both in men and machines, but this was by way of being the first time the new tactics of what the Americans call "vertical envelopment" had ever been tried out on the grand scale (although gliders had been used in Norway and the Low Countries), and doubtless the Germans made many miscalculations and mistakes before they managed to swamp the defenders of Crete by sheer weight of numbers.

When the Allies carry the war right to the enemy's own doorstep and their airborne troops give practical effect to the rigorous training now going on in this country and in America, it can safely be assumed that gliders will be employed in the light of much valuable knowledge gained in the meantime.

There is no secret about the general plan of an aerial



SLEEK TRAINER. The eight-seater Hotspur, produced by General Aircraft, which is now the standard trainer in the Glider Pilots Regiment. Note the raised cockpit cover, giving good view, and the twin-wheel undercarriage which can be jettisoned after take-off.

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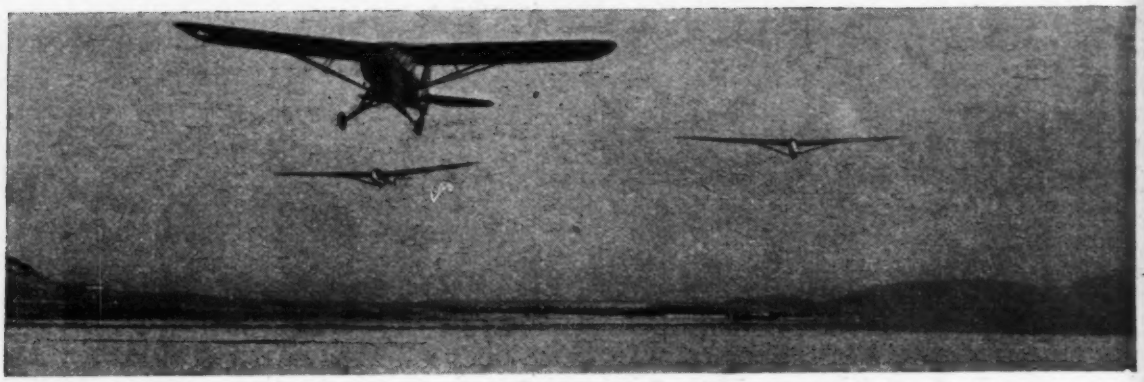


TWIN TOW. Multiple towing of gliders has been the subject of recent experiments. A Vultee-Stinson 0/49 (the Vigilant in the R.A.F.) is shown towing two light training gliders in staggered formation.

WAR GLIDERS

attack. The flying army that lands its forces in the enemy's own country or behind his lines is composed of three main groups. First there are the paratroops, dropped from big transport aircraft, which form the spearhead of the attack. They are the shock troops who, taking the defenders by surprise, seize airfields, cut communications and generally do their best to create confusion. Then come the troop-carrying gliders in their squadrons, casting off from their tugs and gliding swiftly down into any and every field, spilling infantry, squad by squad, until whole regiments and even divisions are in action. Thirdly come the transport aircraft to land on the captured airfields with ammunition, foods and all kinds of supplies for the ground forces, even including tanks, guns, jeeps and other compact forms of ground transport.

The whole operation, of course, must have adequate fighter cover, for on this, plus the degree of initial surprise achieved and the speed and timing of the affair, depends not only its ultimate success, but its cost to the attackers in men and gliders.

To some extent, however, troop-carrying gliders must always be regarded as "consumable munitions," because even under the best conditions, namely when their fighter umbrella maintains complete protection during the landings, it will be inevitable that a fair proportion of the gliders will not be in fit condition to be flown off again, even though they may have landed their occupants successfully; whether it will be possible and worth while to repair them later on depends on a number of factors.

It is chiefly for this reason that the troop-carrying type of war glider does not require the same degree of care to be lavished upon its construction as does the power-driven aircraft; anything in the nature of a high-quality finish would be wasted, for its useful life in action may well be limited to one operational flight. Neither is a very high aerodynamic standard required, since a steep gliding angle with a slow landing speed is all to the good. [A flat glide may be desirable to reach a field, and low drag conserves tug power.—ED.]

Numerical Limits

During the Crete invasion one read newspaper stories of Ju 52s appearing over the island with trains of gliders in tow ranging from six to ten in number, according to their individual size. Such reports, however, can safely be discounted. Thus the idea that minimum drag in gliders would permit more to be towed by any one tug does not apply; other considerations impose a limit on how many can safely be got into the air behind the tug. In general terms, therefore, a sturdily built, slab-sided glider of comparatively rough finish meets most functional requirements, and even then it is necessary to fit spoilers to the wings to ensure a minimum time interval between casting off and landing.

DESERT DERELICT. Many German gliders were found, abandoned by the enemy, when the advancing Eighth Army captured airfields in Libya. This Gotha 242 has not ploughed up the ground in a heavy landing; the earthworks are blast walls thrown up to protect it from the effects of "near misses."

Smaller gliders, of the type used chiefly for training Army glider-pilots, produced both in this country and America are generally quite well finished and aerodynamically much cleaner than the big troop-carriers. While some of these might well be pressed into operational service if the need ever arose, they are not primarily in the "consumable munitions" category, and, as trainers, an efficient gliding angle is desirable to give the pupil the longest possible time in the air after each cast-off during the preliminary stage of his instruction. The fact that some of them land at a fairly high speed may even be regarded as an advantage in a trainer; it provides useful practice in judging the landing approach all the more accurately.

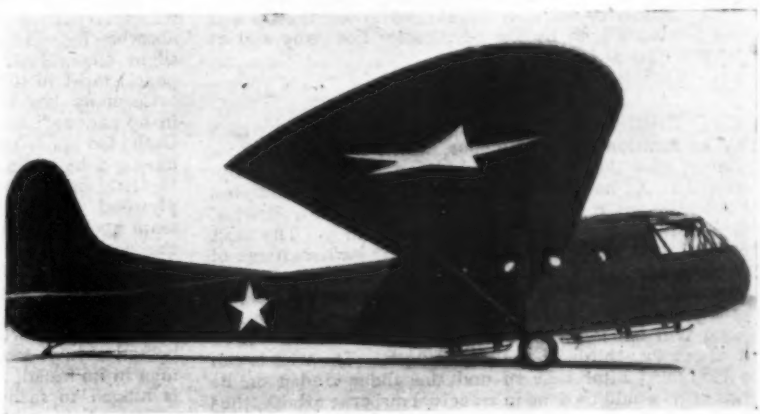
Training in this specialised form of attack has been going on for a long time both in this country and in America. Obviously it is divided into two main sections: the training of glider pilots and the training of the

men who will be carried into action in the gliders. The pilots, of course, revert to the role of infantrymen the moment they have safely landed their craft, and fight alongside their former passengers. As recently described in *Flight*, the Glider Pilots Regiment looks after the training on this side of the Atlantic, while in America the Troop-Carrier Command fulfils much the same duty for the U.S. Army. In addition, the U.S. Marine Corps is also training some of its personnel as glider pilots, at a special school in South Carolina.

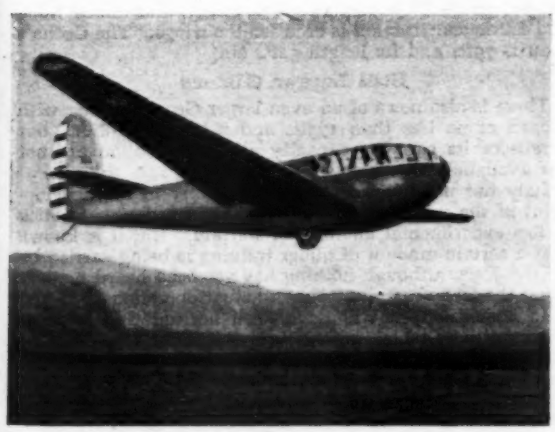
This, however, is part of an experimental programme being now undertaken by the U.S. Navy to explore the possibilities of troop-carrying gliders in sea-borne operations. Experiments are being made in launching troop-laden gliders from aircraft carriers, and in view of the great wing-span of this type of aircraft it would appear to be only possible to use the flush-deck carrier as opposed to the type with "island" superstructure. The problem of housing troop-carrying gliders in a carrier must also be a tricky one and suggests the possibility of quickly detachable wings which also fold at the half-span.

This, of course, is pure speculation since no actual information is available on the point. All that can be said is that at least four gliders, two to carry 12 men and two with twice that capacity, are at present under construction for the U.S. Navy to use in these experiments. Taking our own Horsa glider as an example, it would mean dealing with a span of 88ft., or nearly twice the span of a Skua; the usual span of carrier-borne aircraft is 40ft. to 46ft.; and the Albacore, with a span of 50ft., is about the present limit on British carriers with "islands" to miss. The only information on the American experimental navy gliders is that they are designed as amphibians and are being constructed entirely of one of the recently developed plastic-impregnated wood materials which can easily be worked into any desired shape. They will be flown by naval pilots and most of the tests will be made with Marine Corps personnel.

HORSA, KEEP YOUR TAIL UP! Being the only troop-carrying glider with a tricycle undercarriage, the Airspeed Horsa preserves a level floor for loading and unloading. With a span of 88ft., it provides side-by-side seating in the pilots' cockpit, but its capacity is a military secret.



AMERICAN MODEL. The 15-seater CG-4 troop-transport glider is now in production by both Ford and Boeing for the U.S. Army. Note the extended tail-fin, reminiscent of the Flying Fortress II. The CG-4 is a Waco design with a span of 84ft.



TRIM TWO-SEATER. The American Bowlus two-seater training glider is very well streamlined and has a partly submerged single wheel "undercarriage," plus skids under nose and tail. Its design speed exceeds 100 m.p.h.

Three training-type gliders in use in America are actually adaptations of light power-driven aircraft, namely, the Taylorcraft, Piper, and the Aeronca, while a third type, the Bowlus, is a plywood-plastic product of Bowlus Sailplanes Inc.

Simple Conversion

In the case of the Taylorcraft, Piper and Aeronca, the chief alteration is the provision of a new nose which, in effect, replaces the engine by a third pilot's seat; thus two pupils may be instructed simultaneously, triple sets of controls being fitted. The same wing as before is used but the undercarriage has been shortened since there is no airscrew, and a wooden skid fitted beneath the nose to avoid the possibility of a "ground loop" in a rough or hurried landing in restricted space. These models, of course, remain strut-braced high-wing types like their power-driven parents.

The Bowlus, on the other hand, was designed from the start as a training glider and is a tandem two-seater cantilever mid-wing type, somewhat similar in appearance to the British Hotspur but with certain important differences. Its landing gear comprises a single wheel beneath the centre-section and partly recessed into the bottom of the fuselage, plus the customary skid under the nose. Its

WAR GLIDERS

fuselage is oval in section and well streamlined, and its wings, which have a straight taper and small round tips, are set at a fairly pronounced dihedral angle. The flat tailplane is mounted above the fuselage and well forward in relation to the tail fin and rudder.

A typical example of the American troop-carrying glider actually in production for the U.S. Army is the CG-4, which is a strut-braced high-wing model designed to carry 15 fully equipped men. It weighs 3,000 lb. and is 52ft. long with a span of 84ft., which gives an indication of the carrier problems already indicated as being tackled by the U.S. Navy with their experimental 12- and 24-seater amphibians. The CG-4 has a wide, two-wheeled undercarriage with a pair of skids in front, and a smaller auxiliary pair immediately behind the wheels, under the fuselage. It also has a tail-wheel, and a fin which extends forwards on top of the fuselage very much like that of the Flying Fortress II (B-17E). Designed by Waco and constructed mainly of wood with fabric covering, the CG-4 is being produced both by the Ford Motor Company and at Boeing's Kansas factory.

CONVERTED. This Piper glider is typical of a number of American trainer types which are adaptations of light power-driven aircraft. The Taylorcraft and Aeronca are very similar, their engines having given place to a new nose with a third seat.

British Types

Great Britain has, at present, two types of glider which may be mentioned; the Hotspur, which is being used for training, and the Horsa, which is an operational troop-transport. As has already been said, the general outlines of the Hotspur resemble those of the American Bowlus, but it is much larger and can carry eight men. The most apparent structural difference is that the undercarriage of the Hotspur consists of shock-absorber legs attached to the wings near the roots of the leading-edges and each carrying a pair of wheels. There is a skid under the nose and a long skid under the belly of the fuselage reaching back for about two-thirds of the total length. The wheels can be jettisoned after take-off and the glider landed on its skids; this would be done in an actual airborne attack (thus shortening the landing) but it has been found preferable, for a number of reasons, to use the wheels for landing during training.

CASTING OFF. The glider-pilot pulls a knob on the dashboard when the moment comes to cast off from the tug. It will be noticed that the control column is being held forward in order to bring the glider's nose down to the gliding angle when separation takes place.

The Horsa is one of the British Army's standard troop-carrying gliders, and its span of 88ft. gives a fair idea of its capacity, though the actual load it can accommodate may not yet be mentioned. Built mainly of wood (plastic plywood is extensively used), the Horsa is notable for being the first craft of its kind to be fitted with a tricycle undercarriage. The two main wheels are mounted on a split axle and supported by shock-absorber legs attached to the wings near the roots. The single nose wheel is carried in a fork on a short, vertical shock-absorber leg. The top surface of the wing is flat, but a slight dihedral effect is given by the fact that the outer panels taper in thickness on the underside.

Germany has two chief types of troop-carrying glider in operational service, namely, the DFS 230 A-1 and the Gotha Go 242. The former is a ten-seater of simple design, having a high-wing, braced by single struts, which tapers to fairly small rounded tips. Wooden construction with plywood covering over the leading-edge as far as the main spar and fabric for the remainder is employed for the wings, while the slab-sided fuselage is built up of metal tubing; the nose section is probably plywood covered and the rest fabric. Its span is 71ft. 6in. and the length 37ft.

The Gotha, which has frequently been encountered behind a Ju 52 tug, is designed to carry 23 fully-equipped men in its broad, slab-sided nacelle, the rear end of which is hinged to facilitate quick entry and exit. The high aspect-ratio, rectangular tailplane is carried on twin booms with twin fins and rudders. It is of the high-wing type, with strut-bracing, and the two-wheeled undercarriage, attached to the bottom of the fuselage, can be jettisoned. Three short skids, similar in type to conventional tailskids, are provided, one being under the nose and two under the bottom longerons of the nacelle just aft of the centre of gravity. Metal-tube construction is employed in the nacelle, probably with plywood covering, and mixed wood and fabric construction is used for the wings. The Gotha's span is 79ft. and its length 52ft. 6in.

Still Larger Gliders

There is also news of an even larger German glider with a span of no less than 175ft. and a length of 88ft., but details of its carrying capacity and construction are not yet available.

Italy has not followed her Axis partner in the development of the military glider, preferring, no doubt, to stick to less experimental methods of warfare. But it is known that a certain amount of glider training is being carried on by the Japs, although nothing has yet been heard of their using the troop-carrying type in actual operations.

In conclusion, it will have been noticed that whereas Germany uses metal tubing (probably light steel) for the fuselages of her gliders, America and ourselves employ wood, plywood, and plastic woods—materials which our Transatlantic Allies have classified as "non-strategic." With the rapidly increasing use of these materials, however, in gliders and big transport aircraft, it seems more than likely that they will not remain "non-strategic" for very much longer, and the term will become a misnomer, if it is not already becoming so.

Topics of the Day

A Question of Stability

A Few Remarks on the Subject of "Ground Loops" : Have We Yet Produced the Right Kind of Landing Gear? : The Incidental Importance of Brakes : Unnoticed Engine Failure

ANYONE who is prepared to waste an hour or two watching the landings and take-offs at any advanced training unit is certain, sooner or later (and particularly if there is anything of a cross-wind) to see some very startling and sometimes amusing gyrations. The C.F.I.s and other experts rarely have any sympathy, and the unfortunate pupil is too often on the mat for a performance which can only be blamed on the designers of long ago—the designers who thought that the "back-to-front tricycle" was a good and satisfactory idea.

Only those who, for one reason or another, have felt an aircraft taking charge can have any real idea of what it is all about. The fact is that nearly every "conventional" aircraft is directionally unstable except when it is being pulled along with a nice fat slipstream on the tail surfaces, or when it is going fast enough to have the necessary air control. Aircraft are poor miserable ducklings when they are travelling slowly on the ground.

The other day the fact of this astounding directional instability was brought very firmly home to me when I was in a fast twin-engined machine with no available brake pressure. And I realised how much one *does* depend (without thought—the action is quite reflex) on the brakes for the correction, after landing, of just those little initial movements from the straight which are the beginning of the howling, uncontrollable plunges into the rough. As it happened, there was a slight crosswind, and the landing was not as good as it might have been. The deviation started in a small way, but because the undercarriage is well ahead of the centre of gravity in this particular type, it was automatically built up until it felt as if the entire machine would either go over on its back or pull its undercarriage off.

One had then the strange and appalling case of a heavy aircraft trying to continue in its original course down the runway, while the c.g. was pulling the tail farther and farther round. The poor old thing made the best of a bad job; it turned, with the port tyre screaming and the port oleo leg rammed up solid, until it reached the haven of mud off the runway, when it slid bodily sideways in the direction in which it had originally wanted to go. Fortunately there were no obstructions, and by this time the starboard engine had decided to answer properly to a burst of throttle. We sailed through the rest of the mud like a destroyer going at full speed in shallow water, decks awash with mud and stones.

Low-speed Control

From now on I shall have much more sympathy for the tyro who, even with adequate braking—and consequent steering—arrangements, lets the thing go just too far. For when it *has* gone too far, the amount of braking effort needed to bring the tail round may easily be enough to put the aircraft on its back. Even if there is that much braking power available.

It is all a question of c.g. and the amount of aerodynamic control at comparatively low speeds. The best of aircraft, when incorrectly loaded, can do the most extraordinary things. I remember once, in the Battle of Britain days, being one of fourteen passengers in a docile taxi aircraft. It flew quite well but it was impossible for the load of bodies to be distributed evenly at or near the c.g. Consequently, almost as soon as the wheels touched the ground—and certainly as soon as the tail was down—the entire outfit swung sharply round and faced the opposite way while still proceeding quite quickly in its original direction. Fortunately it was a grass surface and no damage was done except to the nerves of the occupants. Of course, the machine should never have been flying with such a load, but in those days aircraft were badly needed, and any reasonable risk was taken to ensure that the maximum possible number of Hurricanes and Spitfires was delivered to the squadrons in the minimum time.

Quite obviously, any vehicle with the two main wheels in front and a castoring wheel at the back is going to behave queerly when it once goes off the straight. Particularly with the load too far aft and with no positive steering system. The undercarriage as we know it to-day was designed for use with quite different kinds of aircraft—and even some of those swept round in ground loops from time to time if the designer had decided that the dangers of such ground-looping were less than those of going over on the back, and had placed the undercarriage well ahead of the c.g. (Incidentally, the word "ground-looping" is not a really expressive one. It should mean the process of going over on one's back, when, in fact, it means executing a smart semi-circle in the horizontal plane. Or so I believe.)

Two Nose-wheels

I don't feel that the tricycle is the final answer, either. It is a directionally stable arrangement, but far too much depends on the nose-wheel and its shimmy dampers. Furthermore, any "level-landing" system means that there is, practically speaking, nothing but the brakes to stop the aircraft once it is on the ground. The effect of the area presented by the wings and the flaps, when the machine is in a tail-down attitude, is very considerable at high and even medium speeds. Such a loss ought, at least until wheel brakes are more reliable, to be compensated for by the use of some air-brake system.

Generally speaking, however, the level-landing idea, with the c.g. ahead of the main wheels, seems to be the best one at the moment. But is it necessary to have only one small castering wheel in the nose? Why not a sort of four-wheel system? I can foresee the most enormous difficulties in the way of retraction, and it seems to be a mechanical impossibility to design any sort of direct-steering system. Apart from the reaction effects, it would involve another control for the pilot. The only steerable tricycle type I've flown was a very small one, and the nose-wheel kicked the rudder pedals all over the place.

Through suitable damping devices the steerable wheel or wheels *might* reasonably be connected to the control wheel. When on the ground the pilot would have to forget the original flying uses for the wheel—and that might be psychologically impossible or dangerous. Once upon a time I flew briefly in the Hordern-Richmond twin, which had the rudder and the ailerons controlled through a single column; turning the wheel produced rudder effect, and rocking the whole column sideways operated the ailerons. That was difficult enough, though pilots became duly accustomed to it—as they would, of course, if all aircraft were designed that way. I don't know what the final answer may be. I certainly haven't got it, though I'm quite certain that the "back-to-front" arrangement is all wrong, and that something must be done about it.

People have talked quite a lot about the shimmying and other dangers of nose-wheels. They are, I think, liable

A QUESTION OF STABILITY

to imagine that tail-wheels don't now suffer from such troubles. Believe me, they do. Most of the aircraft designed and flown before the introduction of runways can do the most extraordinary things on such surfaces, though they may have appeared to have been quite all right on grass. They're getting better and better, but some of the little wheels still pirouette all over the place and look quite useless as tail-wheels until the speed has been reduced to a walking pace or thereabouts. Fortunately, the movements are not usually so violent that they shake the machine to bits, and designers are learning more and more. Unless the pressures are all wrong, or the tail unit has been distorted, the machine designed or modified since runways became a *sine qua non* do not suffer at all from this annoying trait.

Unsuspected Engine Failure

By way of a change from the subject of undercarriages, I had an interesting experience the other day which helps to prove the contentions of those, myself included, who claim that an engine failure in a twin, other than one from mechanical causes, simply does not register except as a swing that has to be corrected—and is often so corrected quite instinctively.

Soon after I had changed tanks on a medium-sized twin, and while the machine was travelling downhill at about 280 m.p.h., I noticed a tendency for the port wing to drop. As I was quite near to a Fortress at the time, I imagined that I had somehow got into its slipstream. As the wing-down tendency showed no signs of abating, I imagined that a gun panel or some other item had been shed and applied a little aileron bias to correct. Meanwhile, I had pulled up and the speed had reduced itself—quite normally, in my opinion—to 200 m.p.h. Glancing at the various instruments, more as a matter of routine than because I imagined that anything had gone wrong, I noticed that the boosts were right and that the revolutions were more or less right, though the port engine had dropped about a hundred r.p.m. It wasn't until I looked at the port cylinder-head temperature gauge that I realised what had happened; its reading was well below the hundred mark and still falling. Gradually, as the speed dropped to a single-engined performance figure, the port c.s. unit found itself less and less able to hold up the resolutions on "windmilling" alone. Of course, the fuel feed to the port engine had failed—but I had been flying around for fully a minute, and the speed had dropped from 280 to 180 m.p.h., before the fact had become quite obvious, and I can quite imagine that at night, or in the heat of battle, the realisation would be very slow in developing.

It is only unfortunate, as I have said before, that a machine designed to move around the sky at 300 m.p.h. hasn't got very much aerodynamic directional stability once the much greater ground forces come into action at low speeds after landing. Put the undercarriage in the right place, and the ground stability will be as good as the flying stability, and we shall have no more of these youthful capers across runways and over the unserviceable mud which, nowadays, so often forms the rest of the airfield.

"INDICATOR."

Air Transport in the House of Lords

THE debate on air transport was opened by Lord Londonderry in the House of Lords on February 10th. His motion called attention to the "vital necessity of securing for this country a due share in the development of air transport." His Lordship complained that the subject had not received from the Government the official notice due to it. He said he had long felt that air transport should come under the jurisdiction either of a Ministry of its own or, better still, under a reconstructed Ministry of Transport. There were already thirty-four Assistant-Secretaries at the Board of Trade, and he did not think this important subject could be relegated to yet another Assistant-Secretary of that body! Lord Londonderry was convinced that our whole existence as a great Empire Commonwealth depended upon the position we should occupy in relation to the air in a post-war world. The question could not wait for post-war development, and should be recognised as one of our most important war requirements, as it was linked up with transport and troop-carrying aircraft.

These types of aircraft had been produced mainly in America. He did not suggest challenging America, nor did he want cut-throat competition all over the world, but he *was* in favour of rivalry in efficiency. There was a tremendous opportunity for the British Empire, America, Russia and Holland to continue that co-operation and understanding which the war had forced upon us.

Lord Londonderry would like to hear it stated that air transport was an Empire Commonwealth policy, and he hoped that an Empire Air Council was already in being. He wanted the shipping companies to take a lead in the air. He recommended that someone with the dynamic influence of Lord Beaverbrook should take charge of the matter and see that a policy was laid down and put into operation forthwith. On the subject of finance, Lord Londonderry was against subsidies and monopolies. He suggested loans on easy terms.

The views of the Labour Party were expressed by Lord Strabolgi. He wanted the private financial interests in B.O.A.C. bought out; internal airlines free of railway control; and overseas long-distance airlines free of shipping control. He thought we should seek full international collaboration with America and Russia. We must have our own plans ready in partnership with our Dominions so as to have something in our hands wherewith to bargain. He thought we would have to come down to some policy of agreement on the freedom of the air. He suggested making transports of low-carbon steel and wood.

Lord Bennett gave a very excellent review of past history, and expressed the view that if we were not to sink to the level of a second-rate Power we should have air transport services now. Of B.O.A.C. he said the Statute of 1939 provided that no director should have any "likely" interest in any other enterprise, yet one director at least was also a director of a shipping company and another was a director of a railway company.

Lord Mottistone pleaded for the setting-up of a Ministry of Transport and Research.

The Duke of Sutherland said we had neglected air transport, both in war and peace. If we built aircraft for war transport they could, with very little modification, be used immediately after the war for Empire communications. He did not agree that a new organisation was wanted. What we needed was traffic specialists; we had them in the shipping companies. Also, control should be vested in the Board of Trade.

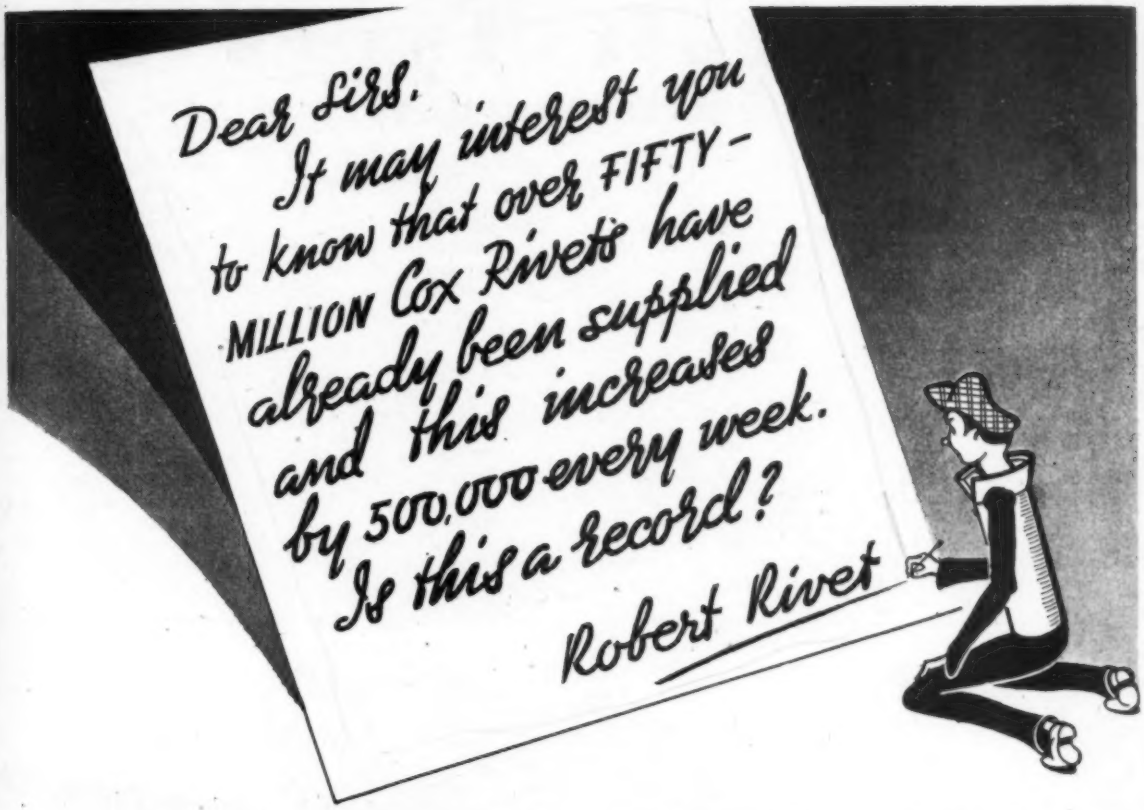
Lord Brabazon of Tara brought their Lordships down to earth by pointing out that we had no aircraft. He pointed out that after the war we should have a lot of military aircraft, the best in the world, which will be useless, while America has 25 per cent. of her industry already building transports. A decision on that position would have to come not from the Air Staff but from the War Cabinet.

Lord Sempill referred to the Avro York, "a development of the famous Lancaster," and suggested that other bomber-designing firms should similarly make transport-type fuselages for their bomber wings.

Viscount Trenchard said the four great Allied Powers should get together and decide if there is to be freedom of the air. That governed everything else.

Lord Gorell deplored that insufficient emphasis was laid on Russia, and thought it essential that for the future of air transport Great Britain, America and Russia should work together. He could not believe that it would be impossible for a certain percentage of our designing staffs to be set aside to plan transports of the future.

The Joint-Parliamentary Under-Secretary of State for Air, Lord Sherwood, replied for the Government—and said precisely nothing!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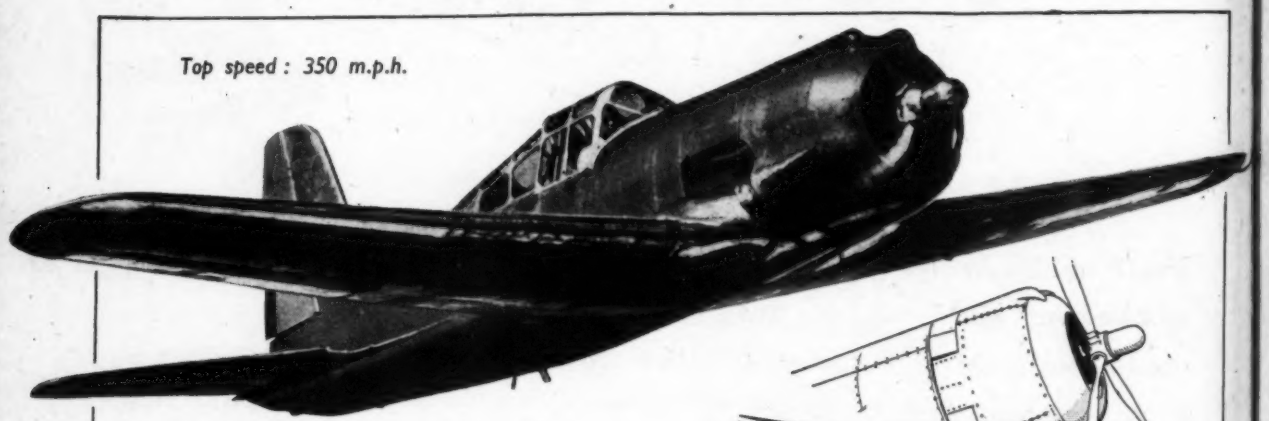
THE first Vanguards to be received by Great Britain were a batch of 100 which had been ordered by Sweden for her rearmament programme, but when Norway was invaded in the spring of 1940, delivery became impracticable and the order was transferred to us; we did not actually receive the first one, however, until about a year later, some 50 of the original consignment having in the meantime been switched to China, whose need of modern fighter types was even greater than ours—or greater than most people knew ours to be, at any rate!

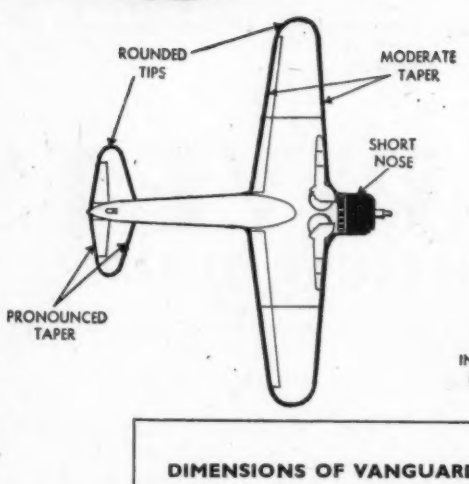
Incidentally, Air Marshal "Billy" Bishop, who later became head of the Royal Canadian Air Force, inspected the first Vanguard to be handed over to the R.A.F. in this country.

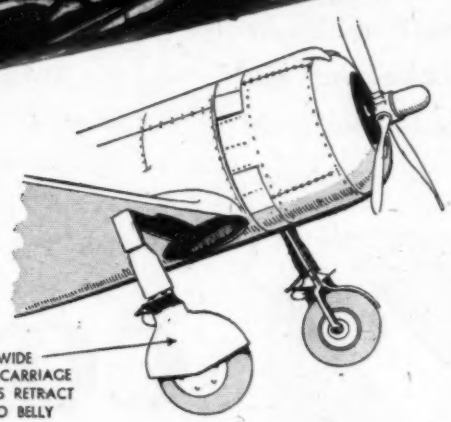
Even in those comparatively early days of the war, however, the performance of the Vanguard was hardly up to the standard of the best British fighters, its top speed being 350 m.p.h. at 15,100ft., and its operating speed 299 m.p.h. at 16,000ft. Its service ceiling, however, was 33,000ft., and it had a useful overload range of 1,190 miles, as compared with a normal range of 700 miles. Its armament of ten machine guns was very good for the usual American idea on this department; it was, in fact, one of the most heavily armed of all American single-seater fighters. Four of its guns were mounted in each wing and the remaining two in the fuselage beneath the decking and synchronised to fire through the airscrew disc.

The power plant consists of one Pratt and Whitney Twin-Wasp 14-cylinder air-cooled radial engine, with two-speed supercharger, developing 1,100 h.p. at 2,250 r.p.m. at 6,200ft., 1,000 h.p. at 2,700 r.p.m. at 14,000ft., and 1,200 h.p. for take-off at 2,700 r.p.m.

All-metal construction with flush-riveted, stressed-skin covering is employed throughout except for the fabric-covered control surfaces. The fuselage is built in two sections, the forward section from engine to cockpit being of welded steel tubing with easily detachable aluminium panels, and the rear section from cockpit to tail unit being a semi-monocoque structure. Flaps of the split trailing-edge type are fitted, and the undercarriage, attached well out on the wide centre-section, retracts inwards; the tail-wheel is also retractable.

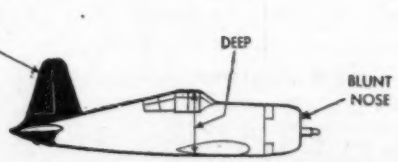






DIMENSIONS OF VANGUARD

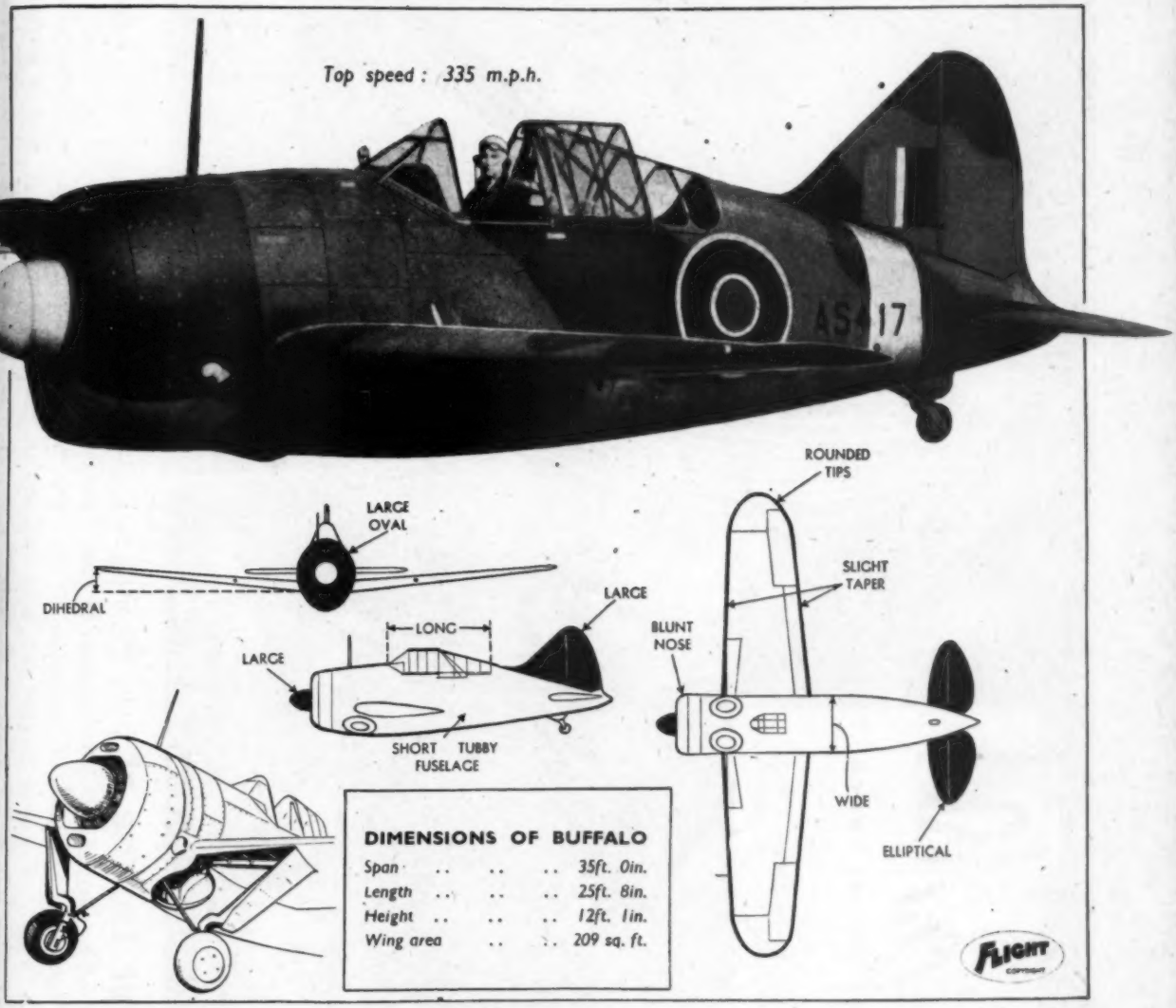
Span	36ft. 0in.
Length	28ft. 0in.
Height	9ft. 5in.
Wing area	197 sq. ft.



FLIGHT COPYRIGHT

heir Characteristics

BREWSTER BUFFALO



THE prototype of the Brewster Buffalo, the F2A-1, made its appearance in 1938, and had a smaller fin area than the version supplied to the R.A.F., which was the F2A-2 in the U.S.A. The U.S. Navy ordered 54 of these compact, tubby little fighters, but agreed to a diversion of some of them to Finland, before the German invasion of Poland. Belgium also ordered some. Then, early in the present war, Great Britain ordered 250 of them for the R.A.F., bestowing on the type the name of Buffalo.

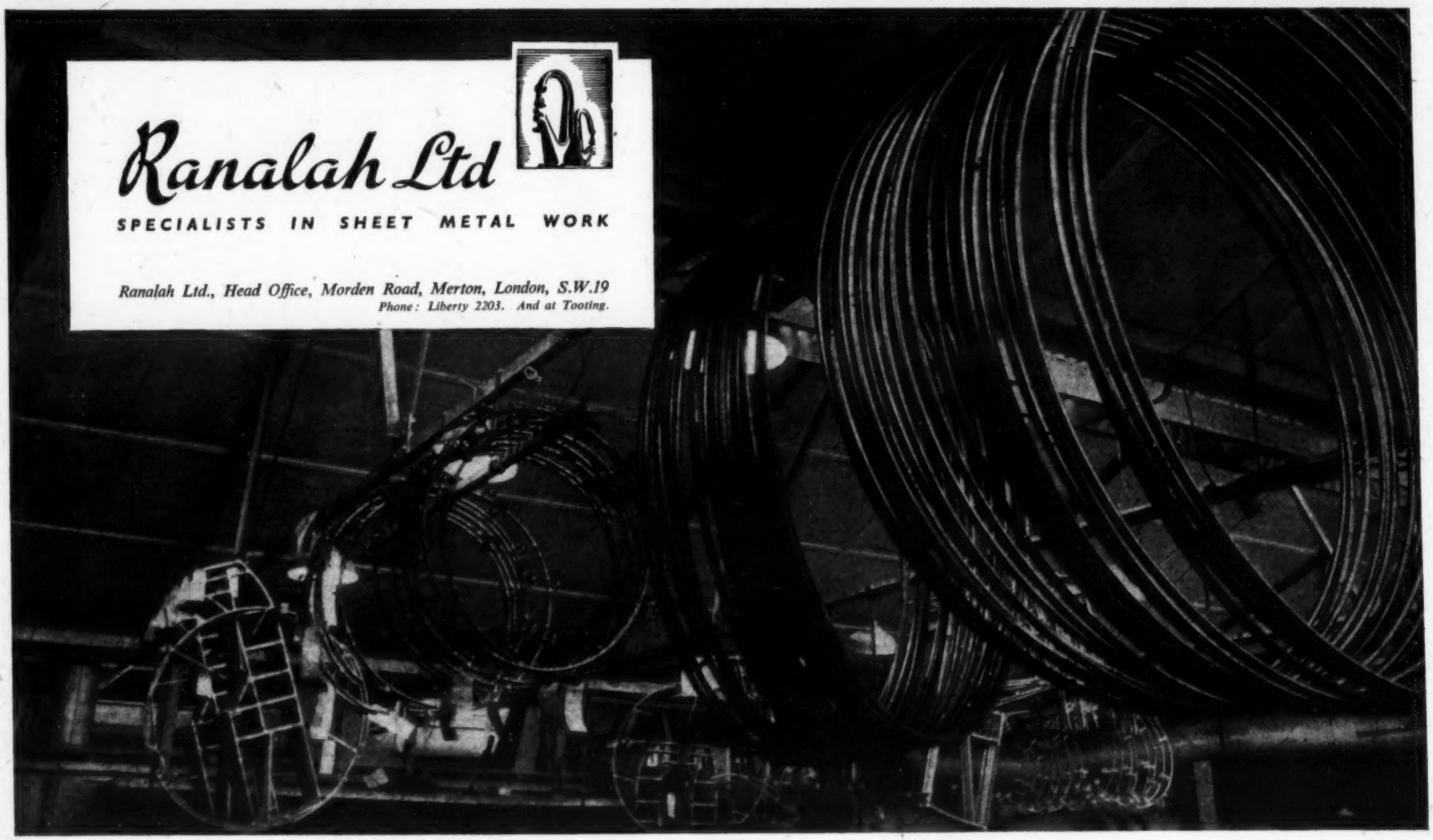
Besides having an increased fin area, the R.A.F. version was fitted with a 1,000 h.p. Wright Cyclone GR-1820-G205A geared and supercharged nine-cylinder air-cooled, radial engine instead of the G-105 model which powered the American production model. The prototype F2F-1 had an SGR-1820-G103 Cyclone engine.

The more powerful G205 engine stepped the top speed up from 310 m.p. to 335 m.p.h., but it substantially reduced the operating range. Still, even with the more thirsty engine, the range was as great as 1,428 miles, which was extremely good for a small fighter, and gave her a certain suitability, not to say advantage, for operational service in the South West Pacific war zone (and the Far East in general) to which the great majority of Buffaloes ultimately found their way.

All-metal construction is employed throughout except for the fabric covering of the control surfaces. The cantilever mid-wings employ a central box beam passing through the fuselage. To this beam are attached the leading and trailing edge sub-assemblies, the portion of the fuselage beneath the centre-section, and the detachable wing-tips. Spars and ribs are of duralumin, and the metal covering is Alclad. Split trailing-edge flaps and Frise-type ailerons are fitted.

The section of the fuselage forward of the fireproof bulkhead is of welded steel tubing, but the rest is an aluminium alloy monocoque built up of bulkheads, formers and stringers, the whole being covered with aluminium alloy, flush-riveted skin. The retractable undercarriage is wide.

The armament consisted originally of four 0.5in. machine guns, two in the wings and two firing through the airscrew disc from tunnels in the top of the cowling.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The Shape of Wings to Come

American Experts Discuss Requirements in the Design of the Post-war Transport Aircraft

BRIEF reference to what the American journals termed an "air cargo engineering meeting," held at Chicago under the auspices of the Society of Automotive Engineers, was made in last week's issue of *Flight*. In this it was recorded that, among a certain diversity of opinion as to just what characteristics should be embodied in the post-war transport aircraft, Mr. Carlos Wood, of the Douglas Aircraft Co., expressed the view that a military cargo aircraft of good design would produce an efficient type for peacetime purposes, whereas Mr. Charles Froesch, chief engineer of Eastern Airlines, thought that specially designed air freight carriers would be needed in the post-war period, and added that, in his opinion, the ideal cargo plane had yet to be built.

The subject is of such interest at the present time, however, that a more complete review of the ideas advanced by these two American experts is warranted, especially as they were made at a gathering (said to be unique in the history of American aviation) which included representatives of the U.S. Army and Navy, the Department of Commerce, the Civil Aviation Administration, manufacturers and airline operators. Various other aspects of the subject, besides that of aircraft design, were, of course, dealt with by other speakers, whose own interests and experience lay in the direction of such matters as the packing and loading of airborne freight, the terminal handling of air cargo, and the economics of post-war carriage of air cargo, but we are concerned at the moment only with the subject of design and such matters as directly affect it. And under this heading, Messrs. Wood and Froesch had a number of interesting things to say.

Mr. Wood began by saying that it was not too late for the results of an analysis of the factors involved in the design of transport aircraft to be useful in the production of cargo planes which would go far towards winning the war. It was now time, also, to investigate the bases of economical operation of cargo aircraft that would go far towards winning the peace.

Cargo Utility Factor

Examining first the military cargo aircraft, Mr. Wood said that for any given unit of transportation, the utility could be expressed as the ability to move a certain amount of pound-miles per hour of men or material; as a result the aircraft which could transport the largest number of pounds at the highest place-to-place speed would be the most useful. The utility of the aircraft was also affected by its landing and take-off distances, the former varying roughly with the square of the landing speed and the latter being a function of the landing speed and the power-loading. These values, again, had their effect on the man-hours necessary to build and maintain usable operating bases. Another consideration was availability in number of aircraft compared with the man-hours needed to produce them. This bore a direct relation to the weight empty of the aircraft, since it had been found that production man-hours were essentially a function of the unladen weight. All these items must be considered in determining what he called the "cargo utility factor," which was a function of the range of the aircraft at a given gross weight, a factor which was a product of a weight ratio and a speed ratio, and a more or less conventional means of assessing the efficiency of operation.

Since these various factors governed the military aircraft, the comparison to the requirements of efficient commercial operation would at once be seen. Man-hours could be expressed in production cost, weight governed operating cost, and landing speed was an index to the necessary ground facilities and the maintenance cost of the aircraft's running gear. Thus the factors affecting "cargo utility factor" represented a cost in man-hours, or in dollars per hour, so that the "c.u.f." was proportional to the pound-miles per dollar. In other words, the higher the value of "c.u.f." the lower the cost per pound-mile, and this led to the belief that common-sense design of good military cargo planes (i.e., aircraft with a high "cargo utility factor") would also produce efficient types for future use in peacetime.

Mr. Wood went on to point out that any good transport aircraft must be "built around the cargo compartment," whether for military or civil use. That compartment must be of adequate size, suitably located in relation to the rest of the aircraft to permit of its fullest use, designed internally to allow efficient handling and best use of available space, and to allow of easy and positive tying down of cargo when loaded.

They could, he said, learn a lot from the humble freight car. Its floor was flat and level and at a convenient height from the ground. The car was about 40ft. long, 8ft. wide and 9ft. high, with side doors large enough to permit rapid loading, and it gave them an idea on the practical compartment size to work towards.

Locating for Balance

The freight compartment on a transport aircraft should be located in respect to the wings so that it held the centre of gravity, whether laden or empty, within the required limits of the aircraft. Generally speaking, about one-third of the compartment's length should be ahead of the 25 per cent. point of the mean aerodynamic chord.

Comparison of current types showed that maximum "cargo utility factor" was not, apparently, a direct function of the aircraft's size. On the other hand, the *range* at which this utility or economy was available did seem to be a function of size only; the larger the aircraft the longer the range at which the desired utility or economy could be obtained. This was due partly to a slowly increasing percentage of useful load with size, and partly due to increasing aerodynamic efficiency with increase in size. The increase in percentage of useful load was not automatic, but was primarily the result of unceasing developments in materials and design.

In order to produce an efficient machine, it was necessary to know under what conditions it was to be used, since for a given size of aircraft the range for which maximum cargo utility was available was a function of the basic lay-out. The basic factors to be considered for a cargo plane were: weight, drag, span, power, stalling speed and handling time; and certain special conditions envisaged for the use of the transport aircraft would often affect its basic design. Usually, however, the design would be flexible enough not to make the aircraft useless except for its one special purpose. To produce a design of good general utility that would also meet—or come close to meeting—a number of special conditions of operation was a prolific source of headaches in the design room. Operation at higher altitudes would, he felt sure, bring circular-sectioned fuselages and supercharged cabins, for most aircraft of the future would carry passengers and cargo, but with proper care many military aircraft would be convertible to civil use. "The military cargo airplanes," he concluded, "will be practically tailor-made for the job."

As a representative of the operating side of air transport, Mr. Froesch did not express any opinion about the merits or otherwise of the military cargo plane for eventual civil use. His most recent experiences had been with the use

THE SHAPE OF WINGS TO COME

of aircraft originally designed as passenger machines and converted for wartime freight carrying, and he naturally approached the subject from this angle, listing ten of the most important reasons why such conversions fall below requirements. A fleet of specially designed air freight carriers would be needed in the post-war era, he claimed.

Ten months ago, he said, the airlines of the U.S. were called upon to begin the transportation of cargo on a large scale for the military services, and the result was that airline equipment was pressed into service literally overnight. Speedy conversions were made; passengers' accommodations were removed, floors strengthened and radio equipment changed to meet military requirements. This conversion was effective, but rather inefficient so far as maximum ratio of useful load to gross weight was concerned. This was partly offset, however, by lifting commercial weight restrictions and increasing take-off weights by as much as 20 per cent. with surprisingly safe and reliable results. The DC-3 was so converted, and later became the C-47 (now called the Skytrain in U.S., and the Dakota in the R.A.F.), and is doing an excellent job, for it now has, in its production version, a large side loading door which the original DC-3 conversions did not possess, of course. Then there is the C-46 (Commando), which is a conversion of the CW-20, a 36-passenger air liner with baggage space below the cabin floor, and the C-54 (Skymaster), which is a conversion of the DC-4 passenger machine. A still more recent modification is the transport version of the Liberator bomber into the C-87 long-range cargo plane. Since none of these aircraft were originally designed or intended for cargo carrying, said Mr. Froesch, none of his criticisms reflected in any way upon their manufacturers; they were not even designed with a view to possible conversion into cargo planes.

Deficiences Examined

In the first place, no one knew just what a cargo plane ought to be, and, with limited experience in this field of operation, much difference of opinion still prevailed on the characteristics and specifications involved in the design of this type of aircraft. It would be helpful, therefore, to examine the deficiencies of the converted air liners, and outline suggested modifications for future equipment.

One of the first snags to be discovered was that the conventional form of landing gear made the loading of heavy articles difficult because of the floor gradient. This was aggravated by the lack of anchor points for hoisting gear. The sloping floor also made an angle with the level loading platform, or truck, alongside, which often resulted in floor damage.

Secondly, it was often found that cabin floors were not strong enough to withstand concentrated loads and rough usage they now got as cargo carriers, so they had to be strengthened, with substantial increase in the aircraft's empty weight. Thirdly, the normal cabin entrance door of a converted air liner was far too narrow and too low, so that the size of cargo pieces was unnecessarily limited, and loading and unloading were seriously impeded. Not only large doors, but two doors opposite each other, would be a great advantage. Lack of proper means to tie down the cargo was the fourth snag, and had necessitated makeshift arangements.

Fifthly, no provisions were readily available for a cargo handler station; and, sixthly, there was a lack of precise, simple information to enable the loaders accurately to distribute the cargo load within the prescribed balance limits. The seventh fault mentioned by Mr. Froesch was that the lavatory was at the wrong end of the aircraft, as it was often difficult to get from the pilot's cockpit, past the cargo, to the rear of the aircraft; and the eighth objection was that there was no provision available for detecting fire among the cargo and extinguishing it, hand extinguishers being the only requisite for passenger aircraft.

Ninth in his list, Mr. Froesch placed the fact that the height of the doorsill from the ground varied with different machines, which again complicated loading from standard motor-truck platform height, and, finally, the usual oval cross-section of the compartment did not permit maximum space utilisation.

Saying that while our primary purpose was to win the war but that we must look deeper and plan for the future, Mr. Froesch shared the view that we must at least try to conceive what air transport operations were likely to be afterwards. "Naturally," he said, "whatever changes are made by following this line of thought will also apply to military cargo aircraft with the exception, perhaps, of speed, which for military purposes must remain more important than operating cost—in saying which he went at least part of the way with Mr. Wood.

The principal service which the air cargo operator had to offer the shipper was the speedy and safe transportation of his products, and he must offer this service at a sufficiently low tariff to attract and continue to carry a large volume of traffic. The lowest possible operating cost per ton-mile was, therefore, the first consideration. In the past, air express volume had been built up on the demand for emergency and perishable shipments which could bear a rate premium, but as such it could never grow to a substantial size. Up to the present, other means of express and freight transport had substantially lower rates per ton-mile, from door to door, than air transport had ever been able to achieve, but if they judiciously interpreted and applied their present knowledge of aerodynamics, improvements in structures and larger engines to the design of strictly cargo-carrying aircraft, they could get their rates down to a level which would compare favourably with surface transport. This would entail, among other things, achieving the necessary speed without reducing the cruising power-loading.

Mr. Froesch said he feared to say too much on the question of aircraft size, except to mention that, because many aircraft components and detail weights did not increase in proportion to the gross weight, the larger types permitted a higher ratio of pay-load to gross weight. The size and capacity of the future transport aircraft could not be predicted until they had made a thorough analysis of the air express and freight market; all they knew at present was that air transportation was here to stay and that its volume would depend on the cost of the service to the shipper and would follow in the wake of rate reduction.

Generally speaking, he favoured the high-wing, twin-engined aircraft with tricycle undercarriage, though for larger capacities and longer range, the four-engined type might be considered superior.

T.C.A's INCREASED TRAFFIC

DURING 1942 air express carried by the publicly owned Trans-Canada Airlines increased 128 per cent. to 396,000 pounds, mail increased 63 per cent. to 2,260,000 pounds, and passengers carried were 106,000, an increase of 24 per cent., according to a year-end statement of H. J. Symington, president of T.C.A. at Montreal. T.C.A. now flies 22,790 miles a day over a route of 4,857 miles. The largest proportion of this is war business. During the year service was extended to Newfoundland and additional flights made between Canadian cities to take care of war traffic.

A.T.A. BENEVOLENT FUND

BELOW is the latest list of donations to the A.T.A. Benevolent Fund. Subscriptions are urgently needed and should be sent to the Treasurer of the Fund at White Waltham, near Maidenhead, Berks.

	£	s.	d.
Subscriptions already acknowledged ..	5,399	9	5
O.C., R.A.F. Station, Little Rissington	58	4	3
A. Shaw and Son	5	5	0
Tapp and Todhill, Ltd.	5	5	0
Harry Parkinson, Ltd.	5	5	0
W. Hudson and Son (Bradford)	1	1	0
A. Wood Mitchell and Son	1	1	0
J. Keenan and Co.		10	0
	£5,476	0	8

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

A Satellite Unit

AN Axis report states that the Croatian Air Force unit co-operating with the *Luftwaffe* on the Russian front has completed 3,698 operational flights, 106 low-level attacks, 151 airfield defence operations, 65 bombing raids, and on 533 occasions acted as escort for bombers, ships, trains and transport aircraft.

A Goering Division

FROM reports in the German Press it appears to be evident that the General Goering Regiment has now been formed into a division. This division is part of the *Luftwaffe* and is fully mechanised. By Hitler's command it will be employed by the German High Command for special tasks, and it is to be composed of tank and mechanised infantry units, and of motor cycle, artillery and A.A. formations.

Bulgarian Rubber

REPORTS from Sofia state that the manufacture of synthetic rubber has been started in Bulgaria. The production of this rubber, which is marketed under the name "Victoria," is said to amount to 110 to 130lb. per day. While the first articles have already appeared on the Bulgarian market it is expected that the production capacity will be further increased to supply Italy with that important material.

Tête-à-Tête

COLONEL GENERAL FOUGIER, Secretary of State and Chief of Staff of the *Regia Aeronautica*, paid a visit to Germany, the object of which was to discuss the problems of industrial co-operation with the leaders of the *Luftwaffe*, and of the German industry. The General was the guest of Field Marshal Milch, and has left Germany after a week's stay.

It is understood that, during his visit, he inspected a number of German aircraft factories and research institutions.

Union in Rubber

A CLOSE collaboration between the French and German rubber industries has for some time been known to exist. Already in 1941 the *Etablissements Hutchison*, the French rubber manufacturing firm of Paris and Chalette, the well-known manufacturers of aeronautical equipment, have concluded a working arrangement with the *Semperit* company, of Vienna.

It is now reported that the Germans supply synthetic rubber to French firms for the manufacture of different articles, which are then sent back to Germany.

Decorations

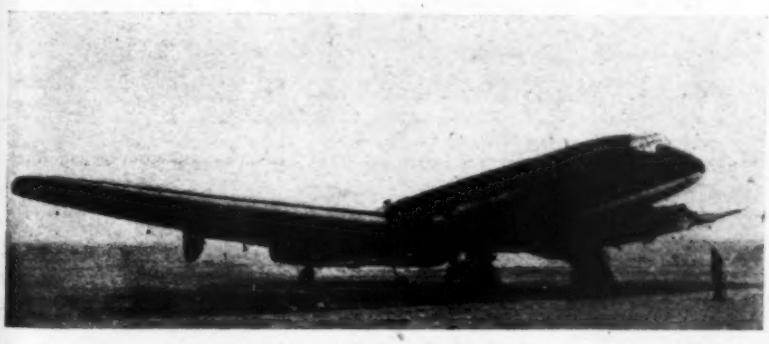
WITHOUT describing their special merits, Italian reports state that Brigadier-General Giuliano Paolo Cassiani-Ingoni has been awarded the Knights Insignia to the Military Order of Savoia. General Ingoni is 46 years old, and has been the Chief of Staff of the Fifth Air Group of the *Regia* since 1942.

The same decoration is awarded to Brigadier-General Mario Piccini, 45 years of age, who since 1942 has been C.-in.C. of *Regia* Units in Slovenia and Dalmatia, and to Brigadier-General Umberto Baistrocchi, Second-in-Command of the Italian Air Force in Sardinia.

Japanese Aircraft

THE establishment of a new aircraft manufacturing company is reported from Japan. The Tokay Aircraft, Limited, has been formed jointly by the Japanese Toyoda Motor Company and the *Kawasaki Kokui Kogyo K.K.*, the well-known makers of Japanese aircraft, of Kobe. The capital of the new company is said to amount to 5,000,000 yen.

Incidentally, it is reported from Tokyo that the Toyoda Company has taken over the control of all branches, assembly shops, etc., of General Motors in the Dutch East Indies.



BOMBER TRANSPORT: The Ju 90, originally designed for passenger traffic, is now produced in two versions for operational and troop-transport duties. It has a span of 114ft. 10in. and an overall length of 86ft. 3in. Powered with four B.M.W. 132 H air-cooled radial engines of 880 h.p. each, the Ju 90 has a top speed of 236 m.p.h.

Liquidated

DELAYED despatches from China say that between 200 to 400 Japanese crated fighter aircraft were believed to have been destroyed on November 26th. On that day American Air Force units sank an 8,000-ton cargo ship in the Pearl River during a heavy bombing raid on Canton. The ship went down after three direct hits and four near misses, and Chinese dock workers report that the river was filled with the debris of the Japanese aircraft presumably carried on the ship.

Light Metals

DESPITE Axis propaganda attempting to show that Japan is now well provided with essential war materials, there appears to be a shortage of light metals for the aircraft industry. For this reason a Directorate of the Light Metal Industry has been created recently, and in co-operation with the Japanese Home Office and the Economic War Planning Board a second Five-Year Plan for the expansion of this industry has been adopted. The plan provides for the erection of new light-metal plants in Korea, Manchuria and Taiwan.

Solid Fuel—

RELENTLESS efforts to expand the motor fuel supply are reported from Germany. Particular attention is being paid to the production of solid fuel for motor vehicles out of a type of inferior coal known as "*Braunkohle*."

In this connection, it is reported that a new company was formed, with a capital of 700,000 Rm., with the object of developing new processes for the production of this type of fuel. According to the German Press, the "*Prolignit A.G.*" is to erect shortly a plant with a daily capacity of 50 tons of "motor coke." Since 2.6 lb. of this fuel equals 1 litre of petrol, this output is said to be sufficient for the consumption of 1,000 to 1,100 motor vehicles.

—and Liquid

AN Italian-German Mineral Oil Company for the Mur region has been established in Budapest with the object of exploiting mineral oil resources in that region of Hungary, which are said to be very extensive. The American Hungarian Petroleum Company, which was taken over by the Hungarian Government at the outbreak of the war, had previously discovered some oil-fields in a neighbouring region near Lispe.

It is further reported that on the Croatian side of the frontier the German Petroleum Company, of Wintershall, has apparently discovered some promising oil sources. On the other hand, less successful are the searches for oil in Germany, where, according to a German trade paper, experimental drilling has been fruitlessly carried out to a depth of 3,811 metres.

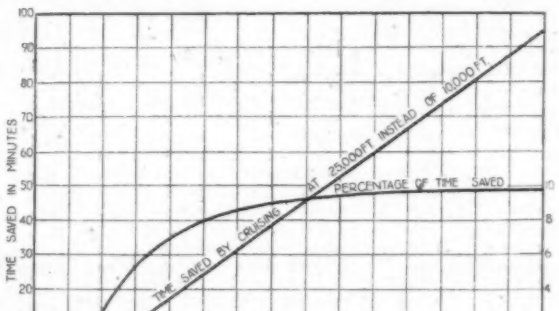
High-altitude Flight

Structural, Physical and Aerodynamic Problems Reviewed : The Meteorological Factor : Pressurising the Cabin

By W. NICHOLS, A.R.Ae.S.

PROBLEMS relating to high-altitude flight were receiving attention in commercial aviation some years before the war. In 1937 flight at an altitude of three to four miles was being seriously considered by the big airline operators in America. The comfort of prospective passengers at such altitudes was also receiving attention. Tests had been made upon pilots and air crews in altitude chambers, i.e., airtight rooms from which air can be pumped to simulate conditions at great altitude. These tests not only showed the faulty reactions of the human frame under conditions of insufficient oxygen, they also provided data on the proper amount that should be furnished for correct reactions. A fairly accurate conception of the problem had been formed when war broke out.

In military aviation considerable progress has been and is being made in connection with high-altitude and stratosphere flight. For obvious reasons the results of such research cannot be included in this article, but in a later section a full description of some of the German developments relating to pressurised cabins will be given. The present article must confine itself mainly to the problems likely to be encountered in the future development of commercial aviation. Flight at great altitudes by the aid of the supercharged or pressurised cabin offers certain definite advantages in speed and freedom from meteorological difficulties. The airline operator is not, however, interested in actual air speed but with the so-called block-to-block time or actual time involved from point of departure to final destination.



Time saved by cruising at high altitude.

High-altitude flight can only offer advantages under these conditions over a route of considerable mileage, for both climb and glide incidental to such flight must be considered. Even for a 2,000-mile range it is necessary to use approximately 35 per cent. distance for the climb and descent. For a 700-mile range practically the entire distance is required for these purposes.

The rates of climb and glide are governed by three factors: physiological, aerodynamic and structural limitations. With regard to the physiological limitation, rate of change of pressure experienced by the passenger should not exceed values corresponding to a climb of 500 ft./min.. or a glide of 300 ft./min. Therefore, if the cabin remains unsupercharged these appear to be the limits of the climb and glide.

An analysis of the aerodynamic limitations shows the best rate of climb to be somewhat higher than the maximum for passenger comfort, and maximum rate of glide should likewise be higher, that is, 1,500ft. to 2,000 ft./min. The third factor, structural limitations, introduces no difficulty during the climb. During the glide, however, the aircraft is restricted to a rate of glide such that dynamic pressure or indicated air speed does not exceed a certain allowable value inherent in the design.

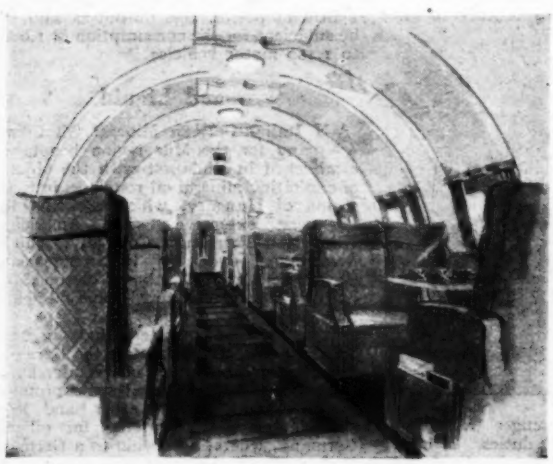
These factors can affect the efficiency of a flight as follows: For aircraft with no pressurised cabin, climb and glide will be limited by the physiological factor; thus efficiency in climb and glide is greatly impaired with this type of aircraft. With cabin supercharging the limit on the climb will be imposed by aerodynamic considerations, thus giving the greatest efficiency, while on the glide the limits will in general be due to the structural factor, thus approaching the most efficient operation more closely than in the case of the unsupercharged cabin.

Time Economy

The aircraft with a pressurised cabin is, therefore, more desirable from an efficiency standpoint, efficiency here meaning economy in time only. A considerable gain is possible at the greater altitudes for the greater distances. This now raises the point over what distances are flights at great altitude, say, 40,000ft. justified. From aerodynamic considerations alone one can arrive at the following conclusions:—

(1) Flights of 500 miles or less should be restricted to altitudes below 15,000 feet.
(2) Flights at altitudes of 15,000 feet to 25,000 feet are advantageous over distances of 500 to 1,000 miles.
(3) Flights at altitudes above 25,000 feet should be justified for distances of 1,000 to 1,500 miles.
(4) Flights at altitudes of 40,000 feet are not economically justified for trips of less than 3,000 miles.

The above conclusions result from the aerodynamic, physiological and structural factors. The meteorological factor, however, also has to be considered. Concerning



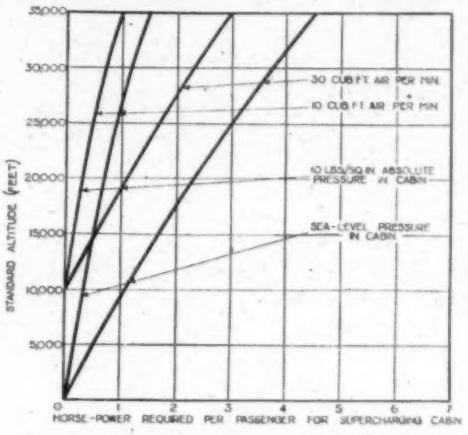
Interior of a projected pressurised air liner by the General Aircraft Co. It is to seat 35 passengers.

HIGH-ALTITUDE FLIGHT

the winds that may be expected at the greater altitudes, it can be said that in general, for mid-latitudes, the westerly component of the wind, i.e., from west to east, will increase with altitude up to approximately the level of the base of the stratosphere, or about 40,000ft. Above this level a decrease in the westerly component will be observed, and winds will actually become east winds at extremely great heights (of the order of 60,000ft.).

Thus maximum west wind will occur near the base of the stratosphere. The normal magnitude of these winds at 40,000ft. is approximately 60 to 70 m.p.h., but this really represents a mode of the frequency of occurrence of these velocities rather than the average. Much greater velocities, say, 120 to 150 m.p.h., can be frequently expected. This, coupled with the fact that these winds are practically unforecastable unless a considerable extension of wind data is realised, makes it appear essential that east-bound flights be made at the great altitudes and west-bound at the lower.

This becomes a serious restriction to be imposed on the design of a high-altitude arcraft, since it must operate efficiently at all levels instead of at its designed cruising level only, as is ordinarily the case. The principal sources of difficulty resulting from this requirement will be encountered in the engine and cabin supercharging control,



Power required to pressurise cabin at varying altitudes.

and an independent supercharger unit will probably be required.

The situation as regards "gusts" at great altitude is considerably more favourable. Gusts, from the point of view of the aircraft designer, may be defined as sudden changes of wind velocity relative to the aircraft. The principal source of gusts will be thunderstorms. In such phenomena the maximum vertical velocities are reached at heights of from 10,000 to 20,000ft. Above these altitudes the vertical velocities will decrease, and above 25,000ft. they may generally be neglected. Design load factors for high-altitude gust conditions will thus be unchanged from those for lower-altitude operation, since these are maximum gust conditions, considering general weather conditions.

Flying at greater altitudes (from 25,000ft. to 40,000ft.) the aircraft will be above any weather conditions—apart from winds—likely to influence its flight. It must be remembered, however, that the aircraft will have to make the ascent and the subsequent descent; during these it may encounter the two most serious meteorological conditions of flight, viz., those of fog and "icing." From this it follows that the high-altitude aircraft must still be equipped in the same manner and must possess the same degree of view as low-altitude aircraft.

Main Problems

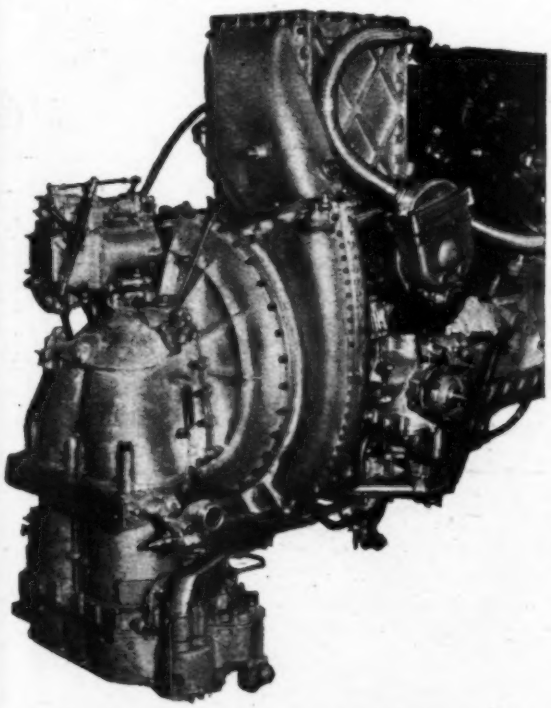
So far only a general review of the factors has been given. When going into the problems in detail it is convenient to classify them into five main groups, as follows: (1) power plants; (2) passenger comfort; (3) structural problems; (4) aerodynamics; (5) maintenance, navigation and operation.

The power plant is, of course, the primary source of all possibilities of high-altitude flight. The advent of jet propulsion may dispense with many of the problems connected with power plants and high-altitude flight, but the commercial realisation of a jet-propelled air liner is some way off. Indeed, turbine-driven airscrews may prove a better proposition for some time to come, both technically and commercially. Some of the problems with the present type of power plant are as follows:

(a) *Engine Ratings.*—Three kinds of ratings are required for high-altitude service: (1) take-off rating based upon maximum permissible power output for short periods at low altitudes; (2) maximum power for protracted periods; this is to be used to reach the final destination in event of failure of one or more power plants and not for normal operation for long periods; (3) cruising rating, which requires maximum power for continuous normal operation. In order to provide quick and safe take-off it is desirable that the take-off rating be 150 per cent. of cruising rating. This large margin of reserve power makes it possible to operate from the smaller airports, and it provides a factor of safety for emergencies.

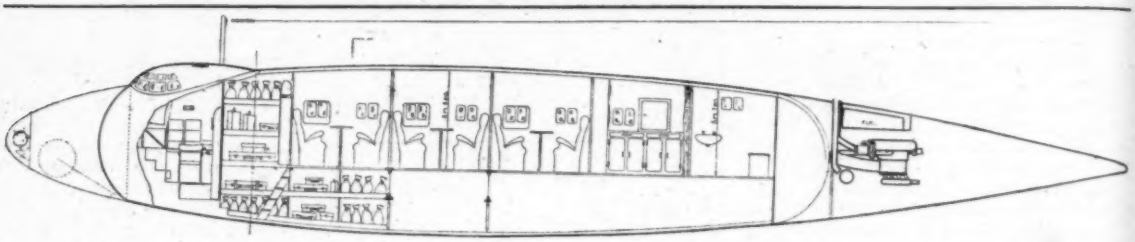
(b) *Fuel.*—Ordinary fuel would probably boil in the tanks if sufficient pressure is not present, and it will probably be necessary to apply cabin pressure to the fuel system.

(c) *Airscrews.*—The critical tip speed velocity decreases with altitude, due to the fact that the speed of sound decreases with density. This makes for lower efficiency. Airscrews with four or more blades (including contra-rotating) become necessary. Such solutions as multi-gear



The two-stage two-speed supercharger feeding the carburettor of the Rolls-Royce Merlin LXI.

HIGH-ALTITUDE FLIGHT



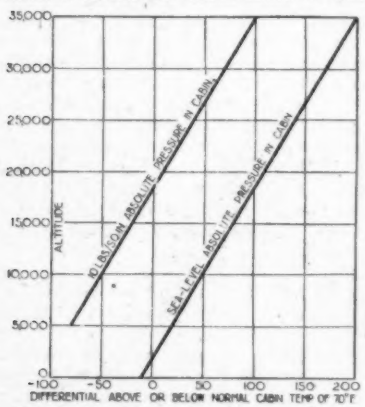
airscrew ratios being incorporated in engines, and variable-diameter airscrews being used, would add to both the weight and complication of the installation and are not likely to find favour.

(d) *Supercharging the Engine.*—The centrifugal supercharger is attractive, since final fuel consumption depends a great deal on the method of supercharging selected. Britain is well ahead in this respect. Progress in the design of superchargers is primarily responsible for the outstanding performance of the Rolls-Royce Merlin 61 at high altitudes. This engine, which takes a Spitfire above 40,000ft., incorporates the first two-stage two-speed supercharger so far in use by the Services.

Passenger Comfort

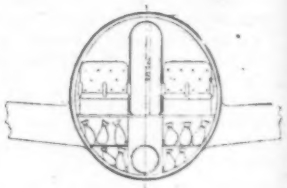
In an article which appeared in *Flight* of December 17th, 1942, entitled "Transport Aircraft," passenger comfort at high altitude was briefly reviewed. Further to those notes, the cabin may be supercharged to sea-level conditions if the airline operators do not wish to lose valuable time on climb and descent. Or, alternatively, cabin pressure may be maintained at approximately 10 lb./sq. in. absolute at altitudes above 10,000ft. If this latter procedure is followed, the internal pressure which the cabin must withstand would be approximately 7 lb./sq. in. absolute at 35,000ft. altitude. At an altitude of 40,000ft. maintaining sea-level pressure in the cabin with a circulation of 20 cu. ft. of air per passenger per minute requires about 2.85 b.h.p. per passenger if 70 per cent. efficiency is derived from the compressor. If it is desired to maintain the pressure equal to 10,000ft. altitude with the same requirement of 20 cu. ft. per minute per passenger, 1.7 b.h.p. per passenger is required.

A normal temperature must be maintained, and at 40,000ft. the air from the compressor will enter the cabin at plus 220 deg. F if sea-level pressure is maintained in the cabin, or plus 145 deg. F. if the pressure maintained is equal to about 10,000ft. altitude. Efficient cooling becomes necessary and at the same time, in the winter season, heat balance within the cabin must be maintained.



Temperature of air from cabin supercharger.

In a subsequent issue suitable heating and ventilating systems will be reviewed. An attractive proposition would be the combination of passenger comfort problems with power plant problems. In this respect the heat available from the exhaust gases could be used in conjunction with a steam boiler and turbine which, properly



Side and end elevation of a General Aircraft 24-seater design, showing the pressurised cabin and the auxiliary engine employed to supply the necessary pressure

designed, could furnish the power for all auxiliary equipment. The modern tendency is to equip transports with auxiliary power plants, and the above scheme offers a solution to this problem. Looking still farther ahead, to supercharge the cabin and feed the engines with the air from the cabin, thus doing away with separate superchargers on the engines, is another interesting proposition, whilst the idea of boundary layer control of the fuselage and wings might be applied by this means.

The best cross-sectional shape for the pressure cabin is obviously cylindrical. In an actual test conducted in the U.S.A., two cabins 11ft. by 37.5ft., one of round and the

When Flt. Lt. Adams established a world's height record on the Bristol 138 in 1936 he wore a suit which was virtually a one-man pressure cabin.

HIGH ALTITUDE FLIGHT

other slightly oval section, were investigated. The cabins were supposed to be supercharged from 10,000ft. to 25,000ft. altitude. The computation revealed that for the slightly oval-shaped fuselage approximately 250 lb. of added weight was required to reinforce the frames in order to overcome the bending stresses due to uneven expansion. For 40,000ft. altitude the weight increase will be about twice this figure. Thickness of the skin in general is not prohibitive, and, as a matter of fact, the pressure in the fuselage gives additional stability to the structure.

Doors, windows and hatches must be kept comparatively small and very strong. For example, at an altitude of 40,000ft. a small door 5ft. by 2ft. must withstand a constant negative pressure of 17,200 lb. Heavy locks and hinges are necessary. The pilot's cabin is one of the most difficult of problems structurally, especially in providing the windscreen. On certain aircraft the difficulty has been solved by dispensing with the windscreen and providing instead a transparent dome made of two or more thicknesses, the inside dome being of approximately ¼in. thick Perspex and the outer dome ¼in. thick Perspex. Warm air is supplied to the space between the inner and outer domes to maintain clear vision.

Other arrangements have also been tried out on the dome principle, but do not generally provide the adequate view essential for the pilot of an air liner. There seems ample scope for the inventive mind to provide a solution to this problem for future air transports of the stratosphere.

Flying controls on ascending to high altitudes have stiffened, and in isolated cases become completely jammed. This may be due to the effect on the viscosity of lubricants used for controls or in causing unequal contractions of the aircraft components; though this, when investigated mathematically, was proved to be almost negligible. Possibly freezing of moisture deposited upon bearings and levers at lower altitudes may be another cause.

Plastic bearings (dry), the reduction of bearing areas, and the introduction of fulcrum devices are possible remedies. Controls electrically or hydraulically transmitted to the control surfaces are desirable, since direct control may become an inevitable source of leakage with a pressure cabin.

The progress in aerodynamic and structural design may lead to high-speed, high-altitude, long-distance, transoceanic air transport at lower cost per mile than that of pre-war services. The increased volume of traffic resulting from this future service would greatly aid in further reducing the cost of aircraft transportation and placing it upon a sound commercial basis.

(Another instalment will be published next week.)

Emergency Landing Grounds in Iceland

ICELAND, in normal times, comes under the Danish crown, but when Denmark was overrun by the Germans in 1940 we took Iceland over until the end of the war.

It has a coastline of nearly 4,000 miles and an area of 40,437 sq. miles, of which thirteen-fourteenths is an uninhabitable plateau of volcanic rock. The population is about 100,000. Since the island occupies an important position from the strategic point of view, Coastal Command have established bases from which aircraft go out on long anti-submarine and reconnaissance patrols. Units of the U.S. Navy and of the Royal Norwegian Navy also operate from Iceland under Coastal Command.

A small party of R.A.F. Officers recently explored the interior, searching for possible emergency landing grounds. The party consisted of the Senior Air Staff Officer, the Station Commander, the Intelligence Officer, and a driver. The Intelligence Officer, a former President of the Oxford University Mountaineering Club, played the part of guide. They spent many days exploring dangerous country. Once they were caught in a snow-drift, tried to dig themselves out, failed and had to walk 20 miles through heavy snow to the nearest house. There were other exciting moments. The expedition eventually proved very worth while. Several emergency landing grounds were mapped and have been shown to air crews flying from bases in Iceland.

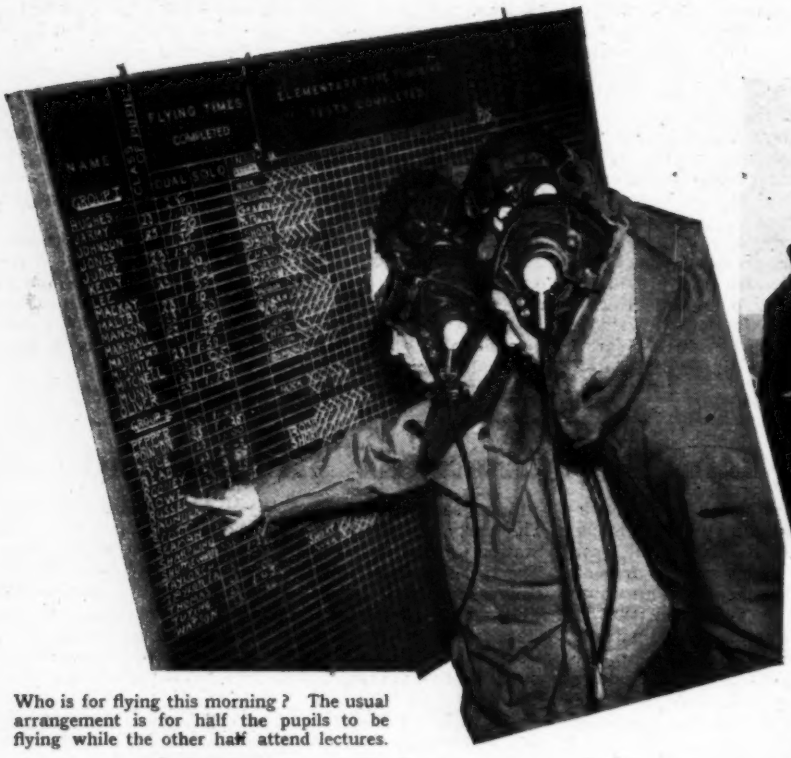
(Top Left) Unpromising as an airfield! The Station Commander watches the steam rising from a hot spring geyser. He is standing on a mound of hot mud.

(Above) Dyngjujokull, until recently believed to be the largest volcano in the world, has a crater thirty-six square miles in area. Here is part of the snow-covered surface. The black patches are caused by hot air and steam blowing to the surface. They show that the volcano is only passive and not extinct.

(Left) The Senior Air Staff Officer takes a turn at digging the car out of a snowdrift.

At an Elementary Flying Training School

Varied Scenes from One of Our Many Establishments of Training Command



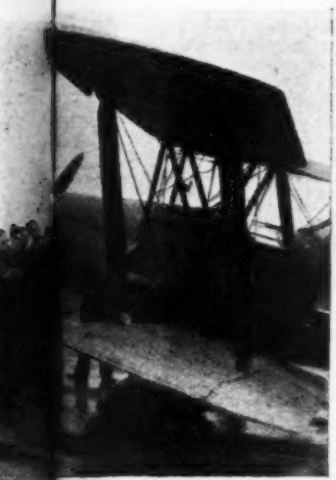
Who is for flying this morning? The usual arrangement is for half the pupils to be flying while the other half attend lectures.

WORKING to a curriculum laid down by the Empire Central Flying School, the Elementary Flying Training Schools carry out the *ab initio* training of Air Force pilots. Lectures in the classrooms, practice on Link trainers, and flying on de Havilland Tiger Moths bring the pupils up to such a flying standard that they are able to find their way on simple cross-country journeys, perform elementary aeroba spins. In t airfield ship, signals, rigging the las becaus the gro not be

(Above) The great moment arrives when the pupil starts his flying career. In a few months' time, when he is flying a Typhoon or a Lancaster, he will wonder why he was ever impressed by the power and speed of a Tiger Moth. (Right) Instruction in how a parachute is packed. Familiarity with the workings of the air lifebelt engenders confidence.

Training

Establishments



Typical pupils in the lecture room. The subjects are handled in an interesting manner and rapt attention is given to the lecturers.

(Left) Not many engines are started by hand nowadays. Nevertheless, it is just as well to know how to do it properly.

aerobatics, and recover from spins.

In the classroom and on the airfield they are taught airmanship, navigation, meteorology, signals, armament, engines and rigging. Only a general idea of the last two subjects is given because these are attended to by the ground staff, and repairs cannot be carried out in the air.

(Right centre and bottom) A few unfortunate mistakes have occurred whereby our machines have been shot down by our own fighters. Recognition of aircraft types is therefore considered to be a very important part of the training

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

AERONAUTICAL UNIVERSITIES

London Degree Merely Postponed

IN your issue of February 4th, 1943, Mr. Greenwood states: "The only university aeronautical engineering degree—that of B.Sc. (Aeronautics) of the University of London—has now been scrapped."

The Royal Aeronautical Society was the prime mover in inducing the Senate of the University of London to create this degree. A representative deputation from the Society discussed with the University the founding of this degree a few months before the outbreak of war.

Owing to the natural difficulties which the war situation has created for education of all kinds, it was not found possible to put the machinery for the degree course into motion immediately. The degree has not, however, been scrapped, but merely postponed for the war period.

J. LAURENCE PRITCHARD,
Secretary, R.Ae.S.

FIGHTER SPEEDS

Differing Problems of Design

IN Mr. C. G. Willey's letter in your journal of February 4th he asks why the speed of modern fighters is inferior to that of the S.6B of 1931. He seems to forget that this aircraft was designed solely for high-speed flying, and not for fighting.

When Mr. R. J. Mitchell designed the S.6B he thought only of speed, disregarding manœuvrability, climb, cockpit area and many other factors which he had to consider when designing a fighter.

For instance, in designing a fighter, easy maintenance would have to be observed. I believe it took about three or four days to change the coolant on the S.6B. The pilot's comfort would have to be considered. On the S.6B a pilot was surrounded by the radiator, and the sides of the cockpit got very hot. As well as speed, other factors must be considered.

The Rolls-Royce "R" engine was solely a racing engine, and would have been useless in a Service aircraft, being much too heavy, and cooling a problem. It was specially boosted for use in the S.6B, and used special fuel. It could not be run for very long, or it would be liable to seize.

I believe Mr. C. G. Willey is mistaken in saying that the S.6B had a two-bladed airscrew. I think it had a primitive form of contra-rotating airscrew.

MICHAEL OSMOND.

[Mr. Willey was correct about the two-bladed airscrew; it was the Macchi which had a contra-prop.—ED.]

A Matter of Engine Development

WITH reference to C. G. Willey's letter in *Flight* of February 4th, 1943, regarding fighter speeds, may I be allowed to try to enlighten Mr. Willey as to why the speeds of modern fighters are inferior to that of the S.6B of 1931? Your correspondent states that the Supermarine S.6B won the Schneider Trophy for Great Britain in 1931 with an average speed of 407½ m.p.h., and that he thinks the speeds of modern fighters should have reached by now speeds in excess of that of the S.6B.

May I ask Mr. Willey for how long could the S.6B keep up a speed of 407½ m.p.h.? Not for very long, I can assure you, and the reason for this is that the engine (a Rolls-Royce "R" of 2,600 h.p.) was specially designed for a S.6B to break the record, and could only run for a certain very limited time.

Consequently, if we had used the same type of engine in the Spitfire or Hurricane these two machines would only have been able to maintain a speed of 400 m.p.h. plus, for about 15 minutes at the most.

The only deduction that one can make from this, then, is that before more speed could be achieved, engine design had to be modified, as it were. Naturally, R.A.F. machines want to maintain speeds of 400 m.p.h. and more for as long as possible, but I am afraid that this would have been impossible without engines much better than that which powered the S.6B in 1931. Therefore the reason for the reduction of speed over the last twelve years is because engine development has taken that time to perfect, and, as Mr. Willey will agree, that without the perfection of engines speed will undoubtedly remain at a standstill.

J. H. DARLINGTON.

Types That Cannot be Compared

YOUR correspondent, Mr. C. G. Willey, asks why most present-day fighters fall short of 400 m.p.h. when the S.6B of '31 did 407.5 m.p.h. I think I can give the answer. The real reason is that the two types cannot be compared—racing machine and fighter. The Rolls-Royce "R" engine of the S.6B gave 2,600 h.p., but was guaranteed for only five minutes, although it actually ran over 40 minutes; a modern fighter needs a motor to run for hundreds of hours with almost no attention. Also, although the first Merlin only gave about 1,000 h.p., the present Merlin LXI is in the 2,000 h.p. class, as has been officially stated. Again, besides the Typhoon, the Spitfire IXB has an official speed of over 400 m.p.h., following closely, indeed, the Typhoon. And to do 367 m.p.h. on 1,030 h.p. is not bad, you know. There are other types, still on the secret list, doing well over 400 m.p.h.

G. R. SATCHLER.

[Many more letters on this subject have been received, but those published are typical of the general comment. The S.6B was handicapped by having to take off with a fixed-pitch airscrew.—ED.]

BOOST CONTROL

More About the Merlin Unit

I READ with some surprise Mr. Wigram Maxwell's article on automatic boost controls in your issue of *Flight* dated January 21st, 1943, and must protest at some of the statements made therein.

First, the boost unit fitted to all types of Merlin engines is entirely of Rolls-Royce manufacture and design. The Merlin type boost control is pneumatically operated and not hydraulically operated as stated in Mr. Maxwell's article.

The object of the "change-over" valve is to maintain the servo piston (which is connected via a differential gear box to the throttle) at one end of its stroke, up to zero boost, by admitting atmospheric pressure to one side of the piston.

The "change-over" valve connects supercharger pressure to the servo piston after zero boost position has been reached. The servo piston on the Merlin boost control does not move until there is sufficient positive pressure in the supercharger to overcome a damper spring which is fitted in the servo piston cylinder. Thus, at all boost pressures below this point the pilot's lever is, to all intents and purposes, directly connected to the engine throttles.

This would account for increase in boost with decrease in r.p.m. at all boost pressures up to zero boost, the supercharger continuing to deliver air at a constant pressure with constant throttle opening. Decrease in engine r.p.m. causes decrease in weight of air required by the engine. However, the supercharger continues to deliver approximately the same amount of air (due to constant throttle opening) and thereby causes an increase in boost in the induction manifold. This increase in boost is also affected by the forward facing air intake on the aircraft and also a slight increase in the velocity of the air when the airscrew is put into coarse pitch.

In the case of an engine running at any given positive boost pressure, the Merlin boost control is then fully operative and any sudden change in airscrew pitch (from fine to coarse) will then cause the engine r.p.m. to drop, but at the same time give an increased air pressure on the forward facing intake and so cause a momentary surge in boost pressure. This will only take place until the boost control has had time to cope with the sudden increase, after which it will automatically close the engine throttles, restoring the boost to its original value, allowing, of course, for a slight error due to sluggishness in operation.

Mr. Maxwell does not make it clear in his article whether the increase in velocity of air that he mentions in connection with decrease in engine r.p.m. is due to alteration in throttle opening.

If the throttle opening is constant, obviously the velocity of air over the chokes decreases with decrease in engine r.p.m.

I would like to point out here that the automatic enrichment for "take-off" boost pressures on the Merlin engine is not connected with the boost control in any way. This enrichment is controlled by a capsule in the carburettor, which is directly affected by boost pressure.

J. SHERRARD.
S.U. Carburettor Service Rep. (late of Rolls-Royce, Ltd.).

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

General Alexander, while C.-in-C. Middle East Forces, inspects the guard of honour at Khartoum airfield during an air tour of Eritrea and Sudan.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED SERVICE ORDER.

P/O. H. G. JORDAN, R.A.F.V.R.—P/Os. Jordan and Paulton and Flt. Sgt. Bigoray displayed gallantry, fortitude and devotion to duty in exceptionally hazardous circumstances.

Act. Flt. Lt. W. T. CHRISTIE, D.F.M., R.A.F.V.R., No. 7 Sqn. (since reported missing).—Since being awarded the D.F.M. this officer has taken part in many operational flights. He has always displayed courage and determination of a very high order, pressing home his attacks on the most heavily defended targets. On one occasion he was detailed to attack Mannheim. In the face of heavy opposition he first dropped flares and then made his attack from a very low level.

DISTINGUISHED FLYING CROSS.

P/O. E. A. PAULTON, R.C.A.F.—For citation see P/O. Jordan.

Sqn. Ldr. W. FLETCHER, D.F.M., No. 158 Sqn.—In December, 1942, Sqn. Ldr. Fletcher, Sgts. Lewis and Kay were captain, flight engineer and navigator of a heavy bomber detailed to attack Turin. While over the target area one of the starboard engines failed. Shortly after the bombs had been released all blind flying instruments failed, and the aircraft stalled and fell into a spin. Sqn. Ldr. Fletcher skilfully regained control, but it was found impossible to climb over the Alps. Despite bad weather and poor visibility, Sgt. Kay navigated the aircraft on another course round the Alps. Sgt. Lewis's cool and skilful manipulation of the petrol completed the team work which resulted in the safe return of the aircraft, after flying some 900 miles with one of its engines disabled.

Act. Flt. Lt. N. S. MILNES, R.A.F.V.R., No. 102 Sqn.—One night in December, 1942, Flt. Lt. Milnes and Flt. Sgt. McDonald were captain and navigator respectively of a heavy bomber engaged in an attack on Turin. South of the Alps heavy anti-aircraft fire disabled one of the starboard engines. Height was speedily lost from 18,000 to 13,000 feet before the barrage was evaded and the bombs released. Severe icing conditions then forced the aircraft down to 5,000 feet, and when breaking cloud, over Northern France, the bomber was menaced by the approach of five enemy aircraft. Although the fighters did not attack, intense gunfire from the ground defences disabled both port engines and the bomber's speed fell almost to stalling point and altitude was lost down to 8,000 feet. The question of abandoning aircraft was considered. Although Flt. Sgt. McDonald was in the best position to effect an escape, he opposed the proposal and Flt. Lt. Milnes decided to struggle on. Soon the port inner engine again functioned, but the aircraft was still flying almost at stalling speed. Eventually the north coast of France was gained and the crippled aircraft was again subjected to intense anti-aircraft fire. Further height was sacrificed in evading the gunfire and the crew flew on and eventually reached safety.

Air Commodore The Right Hon. Winston S. Churchill, P.C., C.H., M.P., No. 601 A.A. Squadron, returns to No. 10 Downing Street from his recent tour to the Middle East.

F/O. K. A. MACKENZIE, R.C.A.F., No. 9 Sqn. (since deceased).—As captain of aircraft, this officer has displayed outstanding keenness and determination to achieve success. One night in September, 1942, in appalling weather he attacked a target in Northern Germany. Although his aircraft was heavily engaged and hit by anti-aircraft fire, F/O. Mackenzie pressed home his attack. He flew with distinction in the daylight raid on Le Creusot and on the more recent raid on Milan.

F/O. W. M. MASON, R.A.F.V.R., No. 44 Sqn.—This officer's standard of navigation is exceptionally high and during his many operational sorties he has obtained some excellent photographs. Recently he took part in the raids on Milan and Genoa and his personal courage, skill and zeal in ensuring that his aircraft reached the target, greatly inspired the whole squadron.

F/O. E. W. N. MORGAN, R.A.F.V.R., No. 218 Sqn.—During many operational sorties F/O. Morgan has shown a high degree of navigational ability. One day in August, 1942, when operating over enemy waters, extremely bad weather was encountered; nevertheless he succeeded in locating the target and in navigating his aircraft back to base.

F/O. L. A. E. OSBON, R.A.F.V.R., No. 101 Sqn. (since reported Prisoner of War).—As navigator, this officer displayed outstanding ability. He flew with several different captains, but always with the same keenness and determination to give of his best. On a number of occasions, in circumstances of bad weather or heavy opposition, his fine navigation has been mainly responsible for the safe return of his aircraft.

F/O. T. W. PIERCE, R.C.A.F., No. 15 Sqn.—F/O. Pierce has displayed great ability and efficiency as a navigator. On several occasions he has participated in sorties, when outstanding photographs have been taken of target areas. After a recent attack on Genoa, his aircraft was forced to return via the Alps at a height of 6,000 feet. Owing to the navigational skill displayed by F/O. Pierce, his captain was enabled to find a safe route and fly the aircraft through the valleys without mishap.

F/O. J. J. RICHARDSON, R.N.Z.A.F., No. 489 Sqn.—One day in September, 1942, this officer was captain of an aircraft in a formation which successfully attacked a strongly escorted enemy convoy off the Norwegian coast. He pressed home his attack with great determination, hitting a 5,000 ton ship which was afterwards confirmed as sunk. Again in October, 1942, while on anti-shipping

SERVICE AVIATION

reconnaissance duties off the Norweigian coast, he sighted an enemy transport escorted by three Ju. 88s. Despite the presence of the enemy fighters, F/O. Richardson attacked from close range, afterwards engaging one of the escorting aircraft.

F/O. D. J. SHANNON, R.A.A.F., No. 106 Sqn.—This officer has taken part in a large number of attacks on industrial targets in enemy territory and has invariably displayed the utmost courage and determination, especially in long-range daylight raids.

F/O. D. R. WALKER, R.C.A.F., No. 106 Sqn.—F/O. Walker has displayed great ability as navigator. He has made many operational sorties against a great variety of targets. He participated in the daylight attacks on Le Creusot and Milan, in which considerable success was achieved.

P/O. D. N. BRADFORD, R.A.F.V.R., No. 78 Sqn.—P/O. Bradford has on many occasions been responsible for obtaining the necessary wireless assistance to enable his aircraft to return safely to base in bad weather. In his capacity of squadron wireless leader, he has displayed keenness, efficiency and an intimate knowledge of wireless organisation.

P/O. B. V. CASKIE, R.A.F.V.R., No. 142 Sqn.—P/O. Caskie is an excellent navigator, being resourceful in all circumstances. His determination and devotion to duty are reflected in the efficiency of the crew of his aircraft.

P/O. H. R. CLARKE, R.A.F.V.R., No. 50 Sqn.—This officer, as rear gunner, took part in the "1,000-bomber raid" on Cologne, a target which he had attacked on two previous occasions. His work as gunnery leader has done much to improve the operational standard of gunners throughout the squadron.

P/O. J. L. COOPER, R.A.F.V.R., No. 106 Sqn.—On numerous occasions P/O. Cooper has displayed outstanding courage and initiative. He has participated in many attacks on targets in the Ruhr, and in mine-laying operations in enemy waters. In the daylight raid on Milan he descended to a height of 4,500 feet to bomb the power station.

P/O. G. R. CRADDOCK, R.C.A.F., No. 419 (R.C.A.F.) Sqn.—This officer has participated in many successful operations as a rear gunner, and has always shown exceptional coolness in the face of intense opposition and danger. On one occasion, whilst returning from Hamburg with only one engine functioning, he jettisoned as much equipment and ammunition as possible, thus enabling his captain to reach the English coast, where a forced landing was made successfully. On another occasion his aircraft was attacked by a hostile fighter. Owing to his understanding of evasive action, P/O. Craddock was able to give his captain an excellent running commentary which enabled him to manœuvre his aircraft away from its attacker.

P/O. H. CRISWELL, No. 500 Sqn.—P/O. Criswell has had a long operational career, in which he has performed duties of an extremely varied nature. In February, 1942, he was the pilot of an aircraft from which a hit was obtained on an enemy ship off the Dutch coast. One day in August, 1942, he was captain of an aircraft and made a successful attack on a U-boat.

P/O. J. W. P. CURTIS, R.A.F.V.R., No. 158 Sqn.—P/O. Curtis has taken part in many attacks on the enemy's heavily defended targets in the Ruhr, Hamburg and Berlin. As a rear gunner, he has shown exceptional skill, and on several occasions has been instrumental in saving his aircraft when attacked by enemy fighters.

P/O. H. F. FARLEY, R.A.F.V.R., No. 161 Sqn.—This officer has displayed particular brilliance as a wireless operator. Despite having been involved in several crashes, and exposed to great danger in burning aircraft, P/O. Farley has continued to evince exceptional enthusiasm and keenness.

Mast-high Bombing

P/O. J. R. FOX, R.A.F.V.R., No. 59 Sqn.—P/O. Fox has a long record of operational flying. Previous to September, 1941, he had completed many operational sorties, including two photographic reconnaissances over Brest and many shipping strikes off the French and Dutch coasts. Latterly he has flown as air gunner to his flight commander, during which period three enemy ships in convoy have been successfully bombed from mast height despite heavy opposition. On one occasion the aircraft in which he was flying was engaged in daylight by a Ju. 88, but after four attacks the enemy aircraft was driven off by the accurate fire of the gunners.

P/O. R. GAYLER, R.A.F.V.R., No. 102 Sqn.—P/O. Gayler is a wireless operator of outstanding merit who has taken part in many operational sorties. His quiet efficiency, calm and imperturbable manner in the face of danger and his offensive spirit have been a source of encouragement and inspiration to his crew.

P/O. W. W. GRIFFIN, R.A.F.V.R., No. 57 Sqn. (since reported missing).—P/O. Griffin has taken part in many operational sorties, including recent attacks on Le Creusot, Genoa and Milan. He is a very able navigator with an exceptionally fine operational record.

P/O. A. HAWORTH, R.A.F.V.R., No. 214 Sqn.—This officer has taken part in many operational sorties and it is due to his conscientious hard work and skill as navigator that his crew have been so outstanding in their attacks and have secured so many excellent photographs. He was serving in this capacity on three occasions when attacked by enemy fighters and succeeded in destroying two of them. On each occasion, with great coolness and determination, he navigated his aircraft to the target which he bombed successfully.

P/O. H. S. HILL, R.C.A.F., No. 405 (R.C.A.F.) Sqn.—This officer has always shown a fine offensive spirit and in all his attacks he has displayed initative and determination of a high order. On one occasion, when returning from an operation, his captain and navigator fainted owing to oxygen failure, and the aircraft went out of control. He lifted the captain from the pilot's seat, righted the aircraft and piloted it until, at a lower height, the captain recovered and was able to take over the controls.

P/O. G. A. HOLMES, R.C.A.F., No. 61 Sqn.—For nine months this officer has served as rear gunner and has taken part in many operational sorties. Throughout, his irrepressible cheerfulness has been an inspiration to all other aircrews.

P/O. T. E. HUGHES, R.A.F.V.R., No. 78 Sqn.—P/O. Hughes is a wireless operator/air gunner who has consistently displayed efficiency and imperturbability in the air. He can be relied upon to meet any emergency. His cheerful personality and capable supervision of wireless matters in the squadron are of the greatest value.

P/O. G. S. HYNAM, R.C.A.F., No. 420 (R.C.A.F.) Sqn.—This officer. who has taken part in attacks on many of the enemy's most heavily defended targets, has achieved success with almost unfailing regularity. He is a gallant and determined captain of aircraft, who has always pressed home his attacks with the greatest resolve and spirit.

P/O. C. W. B. KELLY, R.N.Z.A.F., No. 751 (R.N.Z.A.F.) Sqn.—This officer has participated in sorties against some of the most heavily defended targets in Germany, ensuring success by his highly developed navigational skill.

P/O. H. H. KIRBY, R.A.F.V.R., No. 420 (R.C.A.F.) Sqn.—This officer has taken part in numerous sorties, including attacks on targets in the heavily defended Ruhr area as well as at Rostock and Lubeck; he has also completed several mine-laying sorties.

P/O. L. R. MANN, R.C.A.F., No. 420 (R.C.A.F.) Sqn.—As wireless operator/air gunner, P/O. Mann has displayed courage and efficiency of the highest order. On several occasions, by his technical skill he has enabled his captain to fly a badly damaged aircraft safely to base. He has taken part in operations over the enemy's most heavily defended areas.

P/O. B R. MCNAIR, R.A.F.V.R., No. 106 Sqn.—Throughout his operational tour, P/O. McNair has performed his duties as navigator and bomb aimer with great skill, courage and efficiency. He has participated in attacks on heavily defended targets, including Cologne, Bremen and Rostock, and in the daylight raid on Milan.

P/O. J. R. MORRISON, R.C.A.F., No. 405 (R.C.A.F.) Sqn.—This officer inspires all with whom he comes in contact. On operations, he is cool and collected and, as an air gunner, he has set an exceptional example.

P/O. L. J. O'CONNELL, R.C.A.F., No. 407 Sqn.—This pilot has participated in a number of operational flights against enemy shipping and also in a large-scale raid on Bremen. On all occasions he has pressed home his attacks with exceptional fortitude and determination, often in the face of most intense and concentrated enemy fire.

P/O. E. W. WEYLE, R.A.F.V.R., No. 12 Sqn.—This officer has taken part in many sorties, including such targets as Cologne, Essen, Bremen and Hamburg. He is extremely painstaking and plans all his operations with great care beforehand.

F/O. W. F. PARKS, R.C.A.F., No. 408 (R.C.A.F.) Sqn.—This officer has participated in many operational sorties over some of the most heavily defended targets in enemy and enemy-occupied territory. On one occasion, when flying over Lille, his aircraft was hit by anti-aircraft fire and severely damaged. With great determination he flew on and attacked his target successfully.

Back to Base on Fire

W/O. A. NICHOLL, R.C.A.F., No. 214 Sqn.—This officer has made many operational sorties, attacking targets in Germany, Italy and Western Europe, displaying superb navigational skill throughout. One night while he was navigator of an aircraft detailed to attack Duisburg, a shell burst in the vicinity and caused the starboard inner engine to catch fire. Despite adverse weather, W/O. Nicholl succeeded in bringing the aircraft back to its base, where the fire was extinguished. Over Bremen in similar circumstances, though one engine has been put out of action by anti-aircraft fire, W/O. Nicholl directed his captain to the target where the bombs were released.

Act. W/O. H. A. WALKER, R.C.A.F., No. 138 Sqn.—As captain of aircraft, this warrant officer has completed many sorties during the past 14 months, the majority of which were of an exceptionally long and arduous nature.

Act. Flt. Lt. J. K. DOUGLAS, R.A.A.F., No. 103 Sqn.—Flt. Lt. Douglas has taken part in many operational sorties. On one occasion, when on a mine-laying operation, much flying in cloud was necessary, and his blind flying instruments became unserviceable. Nevertheless he pressed on with his mission, which he achieved successfully. On a later occasion this officer was detailed to attack Munich. When approaching the target area his aircraft was attacked by an enemy night fighter. His skilful evasive tactics enabled his gunners to destroy the enemy aircraft, after which the target was attacked successfully.

F/O. N. A. WILLIAMSON, R.N.Z.A.F., No. 214 Sqn.—This officer has participated in a large number of successful night operations over Germany and Italy. On one occasion in September, 1942, he was detailed to bomb a target in North-West Germany. He pressed home his attack at low level despite adverse weather and damage sustained to his aircraft. On the return flight a searchlight and gun emplacement were raked with machine-gun fire. In December, 1942, F/O. Williamson attacked a factory from 50 feet, making three separate runs over the objective. During this operation his gunners inflicted damage on two railway trains with machine-gun fire. When leaving the target area the bomber struck a tree and received considerable damage, but, displaying superb airmanship, F/O. Williamson flew his aircraft safely back to base.

P/O. L. W. POWELL, R.C.A.F., No. 412 (R.C.A.F.) Sqn.—P/O. Powell has taken part in many operational sorties. Recently he has been engaged on a number of low-level attacks against the enemy, during the course of which he has severely damaged 19 locomotives.

P/O. S. C. COSBURN, R.C.A.F., No. 401 (R.C.A.F.) Sqn.—During the past year P/O. Cosburn has participated in numerous operational sorties. He has proved himself to be a courage-

Captain M. S. Thomas, D.S.O., R.N., inspects the remote-controlled 0.5in. dual machine guns of a U.S. Fortress which force-landed at a Royal Naval air station.

ous and skilful fighter-pilot, and has destroyed one enemy aircraft, shared in the destruction of another, and damaged others.

BAR TO DISTINGUISHED FLYING MEDAL.

Sgt. T. FLETCHER, D.F.M.—In December, 1942, Sgt. Fletcher was captain of an aircraft detailed to rescue six men seen on a raft some eight to ten miles east of Dover. In spite of the rough conditions, he dropped a smoke float and successfully landed on the sea. The aircraft was taxied up to the raft, and, with the aid of a boat-hook, one man was helped into the aircraft. The rough sea and increasing darkness made further attempts most hazardous. Nevertheless, Sgt. Fletcher persisted in his efforts, and after four attempts succeeded in rescuing two more. Unhappily in the darkness it was impossible to locate the others, who had been washed off the raft into the sea. During the rescue operations the aircraft was damaged, and it took Sgt. Fletcher over an hour to reach the mouth of the harbour after taxi-ing through three minefields. The three men who had been saved were German seamen. This is the seventh successful sea rescue undertaken by this airman. He is a courageous and skilful pilot who has directly contributed to the rescue of 13 people.

OLD SOLDIERS NEVER DIE: Sgt. C. M. Johnsen, of the S.A.A.F. He arrived in South Africa in a sailing ship in 1893; fought in the Matabele war, 1896-7; the South African war, the Zulu war and the 1914-18 Great War. In this war he has served at Mogadishu and Gil Gil. According to the age given by him when he rejoined the Forces he fought in the Matabele war at the mature age of five!

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. A. M. MCDONALD, R.A.A.F., No. 102 Sqn.—For citation see Flt. Lt. Milnes.

Flt. Sgt. W. W. BIGGRAY, R.C.A.F.—For citation see P/O. Jordan.

Sgt. R. LEWIS, No. 158 Sqn.

Sgt. H. KAY, No. 158 Sqn.—For citations see Sqn. Ldr. Fletcher, D.F.M.

Sgt. L. C. STEVENS, R.C.A.F., No. 218 Sqn.—Sgt. Stevens has taken part in many operational sorties and has proved to be a most successful rear gunner. On several occasions, when attacked by enemy fighters, directions given by this airman have been responsible for the successful evasion of the attacker.

Sgt. J. H. TAYLOR, R.A.A.F., No. 12 Sqn.—Sgt. Taylor, as air gunner, has taken part in many operational sorties. On May 30th, 1942, during an attack on Cologne, his aircraft was attacked by a Ju 88. Despite the severe damage sustained, Sgt. Taylor, by skilfully handling his guns, successfully drove off the enemy fighter. On another occasion, in September, 1942, he participated in an attack on Dusseldorf. Shortly after reaching the Dutch coast the hydraulic lead to the turret of his aircraft burst, but with great determination he proceeded on his mission. Despite a temperature below zero this airman operated his turret crank with bare hands. Throughout this hazardous flight Sgt. Taylor was a great source of encouragement to the rest of the crew.

Sgt. A. H. THOMSON, R.N.Z.A.F., No. 218 Sqn.—As bomb aimer, this airman has displayed remarkable skill. He participated in the "1,000 bomber" raid on Bremen while still at an O.T.U. In August he took part in an attack on Osnabruck. In September, 1942, at Duisburg, he released his bombs on the target although his aircraft was held in a cone of searchlights and subjected to heavy anti-aircraft fire. Two nights later, on the outward flight to Frankfurt, his aircraft was attacked by three fighters. Engine trouble developed but the pilot flew on and Sgt. Thomson succeeded in bombing his objective. His high percentage of successful photographs has proved most valuable.

Flt. Sgt. F. J. BLUTE, No. 12 Sqn.—This air gunner has flown on many sorties in which such heavily defended targets as Berlin, Essen, Cologne, and Bremen have been attacked. On one occasion, in February, 1942, on the return flight from Brest, his aircraft struck the edge of a mountainside in Yorkshire. The ground was covered in snow and it was intensely cold. Flt. Sgt. Blute lay trapped upside down in the rear turret for 12½ hours. After recovery from his injuries he asked to resume operational flying.

Flt. Sgt. W. D. MACMONAGLE, R.C.A.F., No. 15 Sqn.—Flt. Sgt. E. F. WARREN, R.C.A.F., No. 15 Sqn.—In December, 1942, Flt. Sgts. MacMonagle and Warren were captain and mid-upper gunner respectively of an aircraft detailed to attack a target in Germany. When approaching the target, their aircraft was intercepted and severely damaged by fire from two Me 110's. Flt. Sgt. Warren, although seriously wounded, shot one of the fighters down in flames. By skilful evasive tactics the remaining attacker was eluded and the target successfully bombed. On the return flight another Me 110 attacked, and further damage was inflicted on the bomber. The attack was again beaten off, and Flt. Sgt. MacMonagle flew the disabled aircraft safely back to base.

Flt. Sgt. W. F. AUSTIN, No. 103 Sqn.—During the outward flight on a recent sortie against Frankfurt, Flt. Sgt. Austin's aircraft was subjected to six attacks by an enemy aircraft. These attacks were skilfully evaded, and Flt. Sgt. Austin proceeded and bombed his target successfully. On the return flight another attack was made by an enemy fighter, which was destroyed.

Flt. Sgt. D. H. STYLES, R.A.F.V.R., No. 418 (R.C.A.F.) Sqn.—Flt. Sgt Styles has taken part in ninety-nine operational sorties. In May, 1941, he was the navigator of an aircraft which, whilst operating off the west coast of Ireland, attacked and damaged a Ju 88. Since September, 1941, he has participated in a large number of intruder operations over enemy-occupied territories. This airman has always shown great keenness and determination in the performance of his duties. He has flown as navigator in operations that have resulted in severely damaging four locomotives.

Sgt. R. E. WILKES, No. 35 Sqn.—In December, 1942, this captain of aircraft was detailed for an attack on Duisberg. When commencing his bombing run he was heavily engaged by anti-aircraft fire, and his aircraft was badly damaged, two engines being rendered useless. With admirable coolness, Sgt. Wilkes released his bombs, and by skilful evasive tactics withdrew without further damage. Descending gradually, a constant height was ultimately maintained on the homeward journey, until a Ju 88 was encountered, which made three attacks. Displaying superb airmanship, Sgt. Wilkes manœuvred his disabled aircraft to avoid these attacks, and eventually flew safely back to base. On a previous occasion, in the same month, in adverse weather conditions, this airman had persisted in his mission to attack Turin, although shortly after setting out, his airspeed indicator and one engine failed.

B.E.M. (MIL.).

A/C. M. NUNN.—On August 19th, 1942, A/C.1 Nunn was wireless operator in a high speed launch. During operations the launch was severely attacked by enemy aircraft. He remained at his post until his wireless equipment was shot away and on going on deck, found he was the only member of the crew uninjured, the other members being either killed or wounded. He showed great presence of mind by first endeavouring to stop the engines until he was almost overcome by fumes. He then ran to the wheel and continued to steer the launch for the British Coast until some time later he was taken aboard another launch. Shortly afterwards both launches were sunk by the enemy. A/C.1 Nunn has served with high speed launches since December, 1941, and has carried out numerous operations with skill and efficiency.

Roll of Honour

Casualty Communiqué No. 201.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—P/O. H. N. Atkinson; Sgt. E. J. Burbridge; Sgt. R. Culshaw; Sgt. M. A. Fussell; P/O. J. Kruy-Trosch; Sgt. J. H. Miller; Sgt. T. Pascoe; Sgt. C. J. Prior; Sgt. J. W. Redman; Wing Cdr. R. A. Sprague, D.F.C.; Sgt. G. J. Warren; Sgt. J. Worsnop.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. M. Footner; Flt. Sgt. R. J. Helsdon; Sgt. F. G. Stoner; Flt. Sgt. W. Wooldridge.

WOUNDED OR INJURED IN ACTION.—P/O. A. F. C. Valentine.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. G. V. Andrews; Sgt. E. Appleton-Bach; P/O. G. H. Berry; P/O. A. L. Campbell; Sgt. H. T. Cheetham; Sgt. R. J. Cheyne; Sgt. H. Clarkson; Sgt. L. W. Drywood; Sgt. A. F. Fletcher; P/O. T. H. Follett; Sgt. T. Gill; Sgt. D. Johnson; P/O. G. B. H. King; Sgt. R. Laverty; P/O. D. A. Macarthur; Act. Sqn. Ldr. R. L. Mannix; Sgt. R. K. Mead; Sgt. J. Nicholson; F/O. W. B. O'Connor; Sgt. J. L. O'Rorke; Sgt. R. E. W. Page; Sgt. A. W. Robertson; Sgt. V. G. Rowen; Sgt. J. Sanderson; Sgt. J. A. Texter; Sgt. F. R. Thompson; Sgt. R. A. Tiffen.

MISSING.—Sgt. W. J. Antonia; Flt. Sgt. T. R. Armstrong; P/O. D. J. Appleton; Sgt. J. G. Ashton; F/O. F. E. Ayers; Sgt. K. R. Bancroft; Sgt. R. Bentley; Sgt. T. W. Brock; Sgt. D. A. Brown; Flt. Sgt. A. Buckton; Sgt. C. G. Candler; Sgt. G. T. Canterbury; Flt. Sgt. W. S. T. Carter; Sgt. T. W. H. Casbolt; Sgt. G. T. Chisholm; Sgt. J. C. Chittick; Sgt. T. Clarke; Sgt. F. R. Collins; P/O. M. J. Cowan; Sgt. E. Crowe; F/O. R. J. Curtis; P/O. P. A. Davies; Flt. Lt. C. C. H. Davis; P/O. H. Duncan; Flt. Sgt. G. M. Edwards; Sgt. J. Falconer; Sgt. N. Frater; Sgt. D. W. J. Hanson; Sgt. T. H. Hanstock; F/O. A. T. H. Haward; F/O. S. T. Hewitt; Sgt. F. S. Higginbottom; Sgt. R. N. Hildred; Sgt. D. J. Hills; Sgt. J. E. Hughes; Sgt. G. C. G. Hutton; P/O. K. F. G. Inskip; Sgt. F. A. Jones; F/O. F. T. Keeping; F/O. H. Keil; Flt. Sgt. D. C. Lawton; Sgt. W. G. S. McAsh; Sgt. A. McKinlay; Sgt. A. Mannering; Flt. Sgt. T. H. Miller; Sgt. B. C. Mocock; Flt. Lt. G. N. Moir; F/O. J. W. Monk; P/O. P. J. Morice; Sgt. A. Morris; Sgt. R. D. Morris; Sgt. W. W. Morton; Sgt. J. Murchison; Sgt. C. Naylor; Sgt. B. E. B. Neafsey; Sgt. C. Neilson; F/O. J. Owen; Sgt. W. K. D. Page; Sgt. W. J. Parnell; Sgt. J. Patton; P/O. W. H. Perinchief; W/O. B. Raises; Sgt. R. Rawcliffe; Sgt. G. E. Rawson; Flt. Sgt. J. P. Robinson; Flt. Sgt. H. E. Rousseau; P/O. G. W. Sewell de Gency; Sgt. W. Shanks; P/O. H. B. Smith; P/O. T. S. South; Sgt. A. Stansfield; P/O. R. Sword; Act. Flt. Lt. A. E. Thomas; P/O. G. T. Thomson; F/O. J. B. Thornton; Sgt. T. Wallace; Sgt. J. Warren; Sgt. J. E. Watson; Sgt. L. E. Webber; Sgt. C. A. Weymouth; P/O. J. A. White; Sgt. A. L. Wood; F/O. H. L. C. Woolley; P/O. V. J. Wotton; P/O. S. R. Young.

KILLED ON ACTIVE SERVICE.—F/O. G. D. Armstrong; Sgt. J. S. T. Baxter; L.A/C. T. J. Blundell; Sgt. H. J. Buckley; P/O. G. H. A. Butler; Sgt. S. Carter; L.A/C. R. A. Cater; Sgt. R. A. Clark; Sgt. A. Clouting; L.A/C. F. R. Daley; L.A/C. E. H. Fletcher; L.A/C. C. P. Fothergham; Sgt. B. A. Hartley; Cpl. F. C. Harvey; Flt. Sgt. J. H. Kellett; L.A/C. J. K. King; Sgt. M. A. Lundy; P/O. R. W. McI. McKenzie; Flt. Sgt. P. D. Mace; Sgt. H. O. Male; L.A/C. R. A. Purrett; P/O. R. W. Reeves; P/O. C. H. Rudge; A/C.2 C. F. Sargeant; Sgt. W. Stewart; P/O. G. W. Stone; Sgt. C. W. Stratton; Cpl. C. E. H. Strudwick; Sgt. A. Tanswell; Flt. Lt. G. W. Thoroughgood.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Cpl. F. A. Armstrong; L.A/C. L. A. Brewer; A/C.2 R. Butler; L.A/C. J. Doan; L.A/C. H. Hackett; F/O. R. B. Hamilton; F/O. J. G. McCathie; A/C.2 J. B. Pool; L.A/C. C. V. Sales; L.A/C. H. Worrall; L.A/C. R. L. Wrench.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 C. H. Crawley.

DIED ON ACTIVE SERVICE.—A/C.2 J. G. Andrews; Cpl. A. Crosland; Sgt. I. B. Davies; L.A/C. A. T. Fieldhouse; L.A/C. C. F. Keates; Air Vice-Marshal A. C. Maund, C.B., C.B.E., D.S.O.; A/C.1 E. J. North; Cpl. J. L. Parker.

The two W.A.A.F. officers, S/O. J. I. Burroughs (left) and A.S/O. B. I. Gough who, with officers of the other women's services, made up the secretarial staff of the Casablanca conference.

SERVICE AVIATION

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A./CW. E. M. W Riley.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. A. L. Augustinus.
WOUNDED OR INJURED IN ACTION.—Sgt. F. H Cashmore.
MISSING.—P/O. R. Clark; Sgt. E. A. Coates; Sgt. C. G. D. Hains; P/O. K. Millgate.
KILLED ON ACTIVE SERVICE.—Sgt. W. J. Baker; Sgt. J. R. Barlow; P/O. J. Love; P/O. K. Pettiford.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. G. M. Georges; Sgt. W. J. Lawrence; Sgt. G. L. Henning.
MISSING, BELIEVED KILLED IN ACTION.—P/O. F. Bartkiewicz, Sgt. J. J. De Marco; Flt. Sgt. D. G. H. Johnson; F/O. H. K. Pollock.
MISSING.—Sgt. J. Fellows; P/O. B. W. Glickman; Flt. Sgt. A. L. Croll; Sgt. W. R. Hawthorne; Flt. Sgt. H. E. Hill; Sgt. J. A. Hollinsworth; Sgt. R. N. Holmes; Sgt. D. G. Ide; Flt. Sgt. E. H. Kieswetter; Flt. Sgt. A. D. MacDonald; Sgt. J. R. G. McFarland; Sgt. F. S. Millen; Act. Flt. Lt. A. R. Parkinson; Sgt. E. G. Payie; Act. Flt. Lt. V. F. Patterson; Sgt. K. Rushby; Sgt. J. C. Shuttleworth; Sgt. A. J. Skirten; Flt. Sgt. J. G. R. Tough; F/O. G. E. Wallace; Sgt. J. L. Watkinson.
KILLED ON ACTIVE SERVICE.—Sgt. R. A. Patterson; P/O. R. S. Shaw.

Royal New Zealand Air Force

KILLED IN ACTION.—Sgt. C. F. Day; Sgt. B. A. Franklin; Sgt. E. W. Harvey; Sgt. M. A. G. McIntyre; Sgt. S. S. McLean; Sgt. M. J. O'Malley; Sgt. H. R. Welch; Sgt. W. H. Whitcombe.
MISSING.—Sgt. M. O. Clark; Sgt. M. T. Denham; Sgt. C. J. Kendal; Sgt. R. H. McKillop; Sgt. H. W. Pullar; Sgt. C. E. le M. Small; P/O. T. G. Sullivan; Sgt. E. Waters; Sgt. G. C. Wilson; Sgt. B. A. Wisely.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. D. C. Henderson; Flt. Sgt. L. C. Webster.
KILLED ON ACTIVE SERVICE.—Act. Flt. Lt. C. H Butt.

South African Air Force

KILLED IN ACTION.—Flt. Sgt. L. G. Felton; Lt. R. R. Scott; 2/Lt. G. Van der Westhuizen.
WOUNDED OR INJURED IN ACTION.—Lt. A. F. Cloete; Lt. H. C. Wheeler; 2/Lt. W. D. Wikner; Lt. M. C. S. Shepherd.
MISSING.—Air Sgt. A. M. C. P. Donald; Air Sgt. P. M. Gray; Lt. Le Brooks; Major A. C. R. Metelerkamp.
KILLED ON ACTIVE SERVICE.—Lt. Bollemshu.

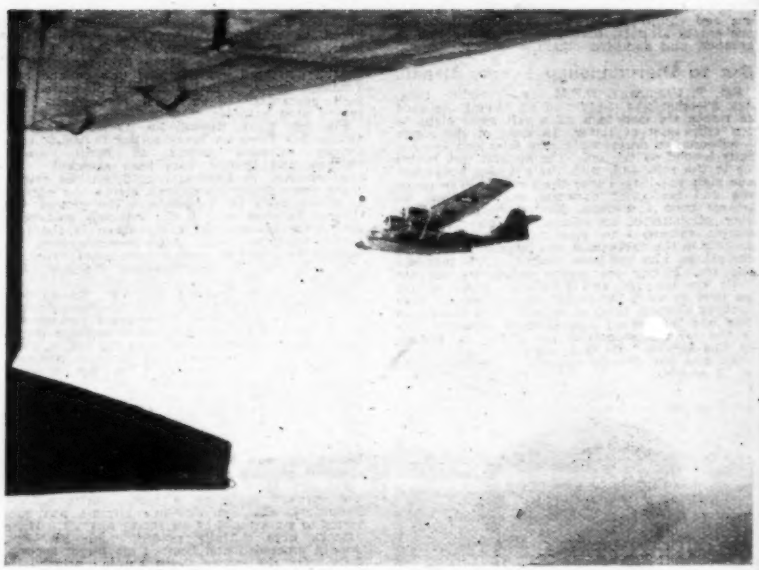
Casualty Communiqué No. 202

Royal Air Force

KILLED IN ACTION.—F/O. J. C. Hodges; Sgt. J. K. Hughes; Sgt. C. R. Kenzie; F/O. H. Knapp; Sgt. B. A. Tidman.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Act. Flt. Lt. A. W. Barnes; Sgt. L. C. Matthias; Flt. Sgt. P. G. Rochford, D.F.M.; Sgt. W. G. Thomson.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. E. L. Bedford; Sgt. K. N. Drake; Sgt. R. Fairhurst; Flt. Sgt. F. F. Garrity, D.F.M.; Sgt. C. S. Harding; Sgt. L. J. Hunter; Sgt. P. F. Inman; Wing Cdr. K. D. Knocker; P/O. W. G. Lapham; Sgt. A. E. Owen; Sgt. T. E. L. Palmer; Flt. Sgt. R. H. Ritchie; Sgt. J. W. C. Underwood; Sgt. B. Whitham; Sgt. A. Whittaker; Sgt. R. Wilde; Sgt. J. W. Wooff.
WOUNDED OR INJURED IN ACTION.—Sgt. R. E. Mercer.
DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. W. F. Austin.
MISSING, BELIEVED KILLED IN ACTION.—P/O. J. R. Agar; Act. Flt. Sgt. F. V. Brook; Sgt. G. G. Chalmers; Sgt. M. C. Colwill; P/O. J. R. Diack; Sgt. A. G. Dunn; Act. Flt. Lt. E. A. Fletcher; P/O. L. C. Gibbin; F/O. R. J. C. W. Giles; Sgt. M. D. Gorton; Act. W/O. G. J. Grayland; P/O. F. Holland; Flt. Lt. C. L. Johnson; Sgt. A. P. Jamieson; Sqn. Ldr. N. H. E. Meservy, D.F.C.; Sgt. C. Riches; Sgt. J. Russell; Sgt. R. E. Webb.
MISSING.—P/O. J. S. Abel; Sgt. R. H. Alvey; Sgt. R. W. Andrews; Flt. Lt. H. Arnott; Sgt. B. Arthur; Sgt. S. H. Atkinson; F/O. A. Bate; P/O. R. L. Boyes; Sgt. E. A. Brookes; P/O. J. W. Brown; Sgt. F. D. Buchwalter; W/O. R. M. Burnham; Sgt. A. E. W. Butler; Sgt. C. G. Calcutt; Flt. Sgt. C. Carr; Sgt. M. J Clayton; P/O. N. Cohen; Sgt. R. J. Coles; Sgt. P. J. Davis; P/O. G. Dawkins; Sgt. D. H. De Grughy; P/O. I. D. Ferguson; Sgt. R. E. Hayman; Sgt. D. W. Hepplewhite; Flt. Sgt. J. A. Hey; Sqn. Ldr. J. R. D. Hird; F/O. H. G. Jones; Sgt. H. Jones; Sgt. A. W. Kendall; Sgt. J. C. Kent; F/O. H. W. Larkins; Act. Flt. Lt. J. G. A. Maguire; Flt. Sgt. R. G. Martin; Sgt. H. Metcalfe; Sgt. R. Montgomery; Sgt. H. Moxon; Sgt. J. Ogden; Sgt. J. T. Pate; F/O. N. J. A. Paton; Sgt. C. R. Pendelpho; Sgt. J. T. Pinkney; Act. Flt. Lt. I. Ralston; Flt. Lt. F. Riley; Sgt. D. M. Sannholm; Sgt. J. W. Simmons; F/O. F. Spicer; P/O. S. A. Venneear; P/O. B. L. Walker; Sgt. W. T. Warren; Act. Flt. Lt. N. R. Watts.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. R. O. Gray; Sgt. W. J. D. Miller.
KILLED ON ACTIVE SERVICE.—L.A/C. J. L. J. Barnes; Sgt. R. C. Beard; Sgt. J. W. Brotherston; Sgt. S. Butz; Act. Flt. Lt. N. A. Butcher; P/O. D. F. Button; Flt. Sgt. A. H. F. Chote; A/C.1 G. Craddock; Sgt. V. T. Drew; Sgt. J. B. Elder; A/C.1 E. L. N. Errington; Sgt. W. R. Evans; Sgt. C. W. Furlong; Sgt. G. Groves; Sgt. F. T. G. Hamlyn; Sgt. N. Hibbert; P/O. A. J. Hicks; Sgt. R. D. G. Hoggins; P/O. K. M. Holroyde; P/O. R. A. Hunnings; Sgt. J. W. Hyde; Sgt. C. Ingram; Sgt. W. Knapton; P/O. H. Landau; P/O. C. C. Login; Sgt. A. W. Mason; Act. F/O. N. Pringle; Sgt. L. C. Race; Sgt. C. E. Raggett; P/O. W. F. Rielly; Sgt. S. Rushworth; Sgt. P. J. Stewart; Flt. Sgt. L. Thomas; F/O. S. Trout; L.A/C. G. G. Warner; F/O. H. G. S. Wyrill, D.F.C.; A/C.1 N. C. Wormall.
WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. S. V. Bailey; Sgt. T. C. Beddowes; L.A/C. F. Bennett; Cpl. J. Clark; P/O. L. W. Gill; L.A/C. R. A. Harris; L.A/C. F. H. Lacy; P/O. B. P. Liddington; Sgt. G. H. Salt; L.A/C. T. W. Shone; L.A/C. J. Walton.
DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. G. H. Fifield; A/C.1 C. P. O'Sullivan; Sgt. W. K. Read.
DIED ON ACTIVE SERVICE.—Cpl. A. Banyard; L.A/C. H. Bellin; Flt. Sgt. J. H. H. Buckerfield; A/C.1 R. Forbes; F/O. P. Greenhalgh; A/C.1 H. B. Hawkins; A/C.1 W. C. Holmes; A/C.1 C. Hutchinson; W/O. G. Lardner; L.A/C. W. McPherson; A/C.2 J. McSorley; L.A/C. J. Martindale; A/C.2 R. C. Millar; A/C.1 W. J. Olliver; L.A/C. F. T. Penney; A/C.1 R. H. F. Rodham; Sgt. H. Roscoe; A/C.1 J. Storrie; L.A/C. L. G. Toms; Cpl. R. J. White.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. T. G. Leitch; Sgt. J. J. Nixon; Sgt. R. W. Ogilvie.
MISSING, BELIEVED KILLED IN ACTION.—Sgt. R. D. McPherson; Sgt. A. G. Smith.
MISSING.—P/O. B. J. Campbell; Sgt. M. L. V. Hass; Sgt. P. L. Looney; P/O. J. W. MacDonald; Sgt. J. M. Mantell.
KILLED ON ACTIVE SERVICE.—Sgt. H. J. Everett; Sgt. L. A. McGuire; Sgt. F. A. Sinclair.
WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt K. S. Cheek.



ATLANTIC PATROLS: A U.S. Navy Catalina flies alongside a Coastal Command Sunderland over northern waters.

Royal Canadian Air Force

KILLED IN ACTION.—Flt. Sgt. R. G. Baikie, P/O. H. E. Dabbs; Flt. Sgt. L. J. Devlin; Sgt. R. J. Middleton; Flt. Sgt. R. G. Smith; P/O. J. D. Stevenson.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. E. G. Alexander; P/O. E. D. Girardot; Sgt. D. S. Kennedy; Sgt. G. Kennedy; F/O. W. D. McCulloch; Sqn. Ldr. J. G. A. McNaughton; Sgt. B. W. Weaver.
WOUNDED OR INJURED IN ACTION.—Flt. Sgt. R. A. Chalcroft; Sgt. R. M. Stewart.
DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. R. D. MacDonald.
MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. M. Andrews; Flt. Sgt. R. E. Bertram; Sgt. S. Jenson; W/O. D. B. McPhail; P/O. J. F. Nicolle; Sgt. J. D. Rae.
MISSING.—Flt. Sgt. L. R. Anderson; Sgt. C. J. Eggleton; P/O. J. L. Fletcher; Sgt. S. Franchuk; Sgt. F. J. Gallagher; Sgt. R. M. George; Sgt. G. L. Harrison; Sgt. W. E. Hawke; Act. F/O. M. G. Moor; Flt. Sgt. L. M. Morelly; Sgt W. D. Pagan; P/O. H. F. Perrot; Flt. Sgt. C. A. Powles; Flt. Sgt. J. R. Rebstock; Sgt. E. F. Stammers; P/O. G. P. Waite; Flt. Sgt. D. G. Williams; Sgt A. J. Wilson.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—P/O. S. F. Fairbairn.
KILLED ON ACTIVE SERVICE.—Sgt. J. E. Armstrong; Sgt. L. R. Arps; Sgt. R. J. Cavanaugh; W/O. J. V. Ensom; Sgt. A. J. Golding; Sgt. H. L. Maughan; Sgt. G. H. Richards; P/O. N. H. G Snelgrove.
WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. F. Jackson; Sgt. R. H. Jones; Sgt. T. B. McAneney; Sgt. J. D. Tuttle.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. E. B. H. Openshaw.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. R. Abbott; Act. Flt. Lt. R. T. Blewett; Sgt. H. S. Brown; Sgt. P. J. D. Cooney; Sgt. K. R. Taylor.
MISSING, BELIEVED KILLED IN ACTION.—P/O. M. W. Dixon; Sgt. T. P. Hurley; Sgt. J. Inskip; Sgt. W. A. O'Malley.
MISSING.—Sgt. H. L. F. Goggin; Sgt. R. Payne; Sgt. N. H. Rowe.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. N. J. Cheney.
KILLED ON ACTIVE SERVICE.—P/O. K. T. Beange; Sgt. W. J. Collins; P/O. R. M. Jones; Sgt. R. L. Jones; Sgt. I. J. Land.

South African Air Force

WOUNDED OR INJURED ON ACTIVE SERVICE.—2/Lt. W. A. Purcell.
DIED ON ACTIVE SERVICE.—Air Mech. G. Rankin.

OFFICIAL CORRECTION

to Casualty Communiqué No. 199. Under "MISSING" delete SGT. E. BATES.